AMATEUR TELEVISION QUARTERLY

VOLUME 9 #3
SUMMER 1996

ISSN 1042-198X
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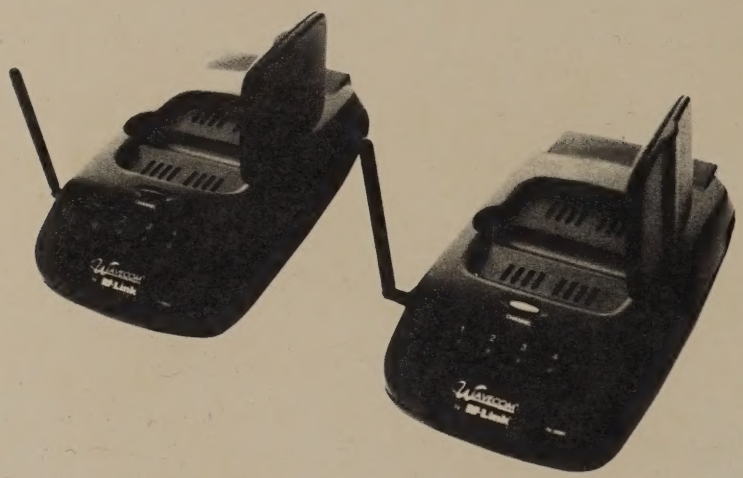

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Redraft of drawings by Bill Parker W8DMR
Typist, Debra Gillespie

COVER PHOTO

Jim, W8AC, received P5 and in color from Chardon, OH, by Jeff WA8SAJ.

HOUSTON GREAT SUCCESS

The HATS group sponsored a state wide ATV conference in Houston on July 13th. ATVQ was there and there will be a full report next issue. There were several excellent technical talks, and on-site equipment checks.

Authors guide: Send in something legible. If you can do it in typewritten (computer print out) form in a laser text great, dot matrix is OK too. You can send it by E-mail to ATVQ on America OnLine, or via the US Snail to ATVQ 3 N Court St., Crown Point, IN 46307. If you send a computer disk, have it formatted to an IBM (dos) machine, not Mac. If possible use WordPerfect, any version, or something that will convert. Diagrams should be clear, on plain paper (not lined) not Xerox copies. Photos can be color or black and white. If you have spell check, use it. Since this is a one person philanthropic effort we do not pay for material. If you want a free subscription in exchange or if I can find any Test Pattern mugs you can have one of those. ATVQ accepts all material at the authors risk. Indicate if you want any of it back. ATVQ also accepts and may publish any mail it receives via its electronic mailboxes. We publish the authors information as it is on the E-mail header. We try to be as accurate as any other publication, but sometimes we are as bad as the others too. Most material is done in WP 5.2 and layout is in PageMaker. 5.0

Because my TV station work schedule starts at 7 am to 7-9 PM, and most weekends lose at least one day to remotes and other broadcast stuff at my real life job, the best way to "talk" to me is via E-mail or fax, lastly the answering machine. You can also find me at home typically Sundays between 10 and 4 if I'm not working, or Saturday 9 to 3 if I am not working. That's how life is these days. 73 Henry KB9FO

ATV DX RECORD

On June 8th, two way 10.4 GHz FM ATV was swapped between Art McBride KC6UQH at Gaviota Pass (north of Santa Barbara) and Ray CLancy N6RE at Torry Pines (near San Diego) for a DX of 204.4 miles. Power output was about +28 dBm with modified Qualcom Omni-Tracks and 3 ft dishes using RHCP. Altitudes were about 200 ft AMSL during this evening over water duct.

The British Amateur TV Club publication CQ-TV issue 172 lists several 10 GHz ATV QSO's with PE1DCD/p with F5RZC, PA0BOJ, PE1EXM, PA0VHF, PE1ECO, G8OZPP, DJ7RI G1XUV and others with ranges to 145 Km and weak sync signals on a 274 Km path from Beachley Head to Start Point (England) Paths of Erie to Wales 182 Km, with P5 pix.

OK, I didn't make Dayton. Work has a habit of interfering with the things we enjoy. I am going to the H-P ATV conference July 13th in Houston I hope to have some good material for the Q from their conference. I am asked two questions from time to time, why is the issue size what it is, and why arent the diagrams better. First, the issue size depends on advertising revenue. The major mags use a ratio of 1 ad page for each text page. I use 2 pages of text to each ad page. Second, you have to send in something to be published. The diagrams are the best from what is sent in. When possible, I bend the arm of Bill Parker W8DMR to redraw the more important ones. Otherwise, what you see is what we got. Any volunteers to be staff artist? Pay is self satisfaction, same as mine. Coming in next issue, RF power amps, and more.

The French ATV'ers have a very nice publication B5+, perhaps we can find a translator.

This issue was sent to the printer July 8, 1996. The deadline for the next issue is Sept 15, 1996. Your feedback is important. Please take a moment and send in your thoughts. The IN box is empty again! Send in your articles and news for the next (Fall) issue.

ATV BALLOON LAUNCH WAS SUCCESS AFTER ALL!

Many of us knew that Ron WA4GSS had made a balloon launch on November 4, 1995 and failed to recover it. Lost for all we knew. If so, that would have been a huge setback for not only would the equipment and thousands of dollars been lost, but many hours of construction also. I was very happy to find out he finally got it back. Here is what Ron has to say about that day...WA8RMC.

I had tested the GPS receiver and TNC for almost a week prior to the launch to get everyone's packet ready. We had trouble seeing the balloon icon on the APRS map so we worked many days to figure that one out. Due to the 10 meter beacon interference with the rest of the equipment, it was left off the package. My goal was to test the GPS receiver and the pico packet TNC along with the High Technology MCM4 micro computer with the video overlay board which all worked. However, we missed checking to see if the 2 meter beacon was turned on. It wasn't.

The balloon launch lasted a little over two hours and because of the jet stream, it out ran our chase teams. The chase team had tracked the balloon payload to within 10 miles of the actual landing site during the decent. With no tracking beacons to DF and many hams looking for two days straight in sub zero temperatures, it looked like I had lost the package forever. The following Sunday morning, I got a call from a ham who said that the balloon package was found near Victor, WV, by a non-ham while hunting on Saturday. Jim Rice, KD4HP, (launch engineer) and I went to pick up the package. It was like a family reunion. All the depression of the previous week was now gone. No more could of's or would of's, but just lots of smiles.

I am planning to have three balloon launches in 1996. I have to figure out how to finance them as I spent way too much money last year out of my own pocket. I will warn you that balloon launches are habit forming and lots of fun.

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ATV BALLOON LAUNCH WAS SUCCESS AFTER ALL!

Ron told me that because the 2 meter beacon wasn't on, tracking was difficult. Also, the 10 meter beacon being left off of the package was the reason they couldn't find it after landing. It was crucial because the radiated signal could have been detected even though the balloon landed in a gully and well below the horizon. I'm sure that it will be included on future missions.

To illustrate the complexity of this package, Ron reports that the following equipment was on board:
4 watt ATV transmitter @ 439.25 MHz
Micro Computer Concepts controller
Pacomm Pico Packet TNC with second port option
VHF Engineering 2 meter transmitter @ 145.79 MHz
High Technology video overlay board
Dipole antennas for other equipment
10 meter CW trans. (left off of package due to QRM to ATV equip)
CCD color camera
Trimble GPS rec. with RS232 option and optional antenna
Radio Shack scanner receiver
High Technology MCM$ computer
Big Wheel ATV antenna
2 meter beacon transmitter @ 144.007 (not turned on)

From ATCO

BALLOON LAUNCH

The ATV Group of Western New York will launch its third High Altitude Helium Balloon (WNY-3) on Sunday, July 28, 1996 at 10:00 am. Live video may be received on 439.25 Mhz, 2 meter CW beacon on 144.34 Mhz and local 40 meter net starting at 9:30 am on 7.232 Mhz +/ QRM. Overlay on video will display call sign of WA2CXW, along with altitude, inside and outside temperatures and other information.

Included on this package is a NASA proposed experiment to sample high altitude particles, this experimental package has been designed by students and instructors at Buffalo State College (SUNY) and Lockport High School. For details, call myself or Roger Garbacz, WA2CXW at 716-937-4478. Thank you. Bob Koster, KA2WYE

Ft. MYERS, FL

The West Coast Area Repeater Club, located in Ft. Myers, Florida, has an ATV repeater with an input on 427.25 Mhz. The repeater is being relocated and is presently uncoordinated. Plans are to retransmit shuttle video from a remote location via 427.25 Mhz link to new repeater location for output on 923.25 Mhz. An additional 70 cm output is under discussion. Plans are to use the repeater for public service events, hurricane recovery operations and shuttle rebroadcast in addition to normal repeater operations.

Dale Hardin, President
West Coast Area Repeater Club
PO Box 839
Ft. Myers, Florida 33902

SEARCH ANT?

Anyone out there using a rotatable "search" antenna on their ATV repeater? We are interested in ideas for remote control of the rotor.Bruce, N0CV

MACCspeak

Subj: Dayton meet Date: 96-05-21 15:14:33 EDT From: Tom O'Hara
To: ATVQ

Just got this relayed to me and thought you might be interested. It is a softer position, but still stops further ATV repeaters and says nothing about putting other modes in the pass bands.

"From: dick@mcs.com Date: Tue, 21 May 96 11:34 CDT Subject: Modified MACC 70 Cm ATV Recommendation To: macc-l@kcmetro.cc.mo.us, coordinator@cs.tamu.edu 21 MAY -1115 CDT

Gentlemen... At the annual meeting in Dayton, Ohio on Friday, May 17th, the Mid-America Coordination Council Board of Directors approved a modification of it's recommendation concerning the coordination of 70 Cm ATV repeaters that was passed in April, 1995. The MACC now recommends that new digital video compression technology be used for ATV as it becomes available, and that the coordination of additional in-band (440 in / 440 out) ATV repeaters be actively discouraged.

In a separate motion, the MACC board now states that the previous recommendation to vacate existing 440 Mhz ATV repeaters effective January 1, 2000, is no longer in effect. Signed George R. Isely, WD9GIG MACC President

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LITCHFIELD, IL

The Central Illinois/St. Louis Area Amateur Television Club will hold their Tenth Annual Banquet on November 30th, 1996. The event will beheld at the Ariston Restaurant in Litchfield, Illinois beginning with happy hour at 5:00 pm and dinner at 6:30 pm. After the meal there will be various award presentations to members for their activities during the past year. The Central Illinois/St. Louis Area Amateur Television Operator of the Year will also be presented at this time.

There will be a program and a large prize drawing to complete the evening's activities. Those active or interested in amateur television are invited to attend and may do so by contacting Scott Millick, K9SM, 907 Big Four Avenue, Hillsboro, Illinois 62049, telephone 217-532-3837, or e-mail to smillick@cnmnet.com. Reservations are required to attend.

THINKING ABOUT PUTTING UP AN ATV REPEATER?

Tom O'Hara, W6ORG ©1996

Here are some things to think about before spending any money.

There is no denying the ego boost of being able to say that you put together a repeater, are the owner, or that it carries your call. And sure you will get a lot of verbal encouragement from the local ATVers for you to do it.

Most repeater owners or builders I have talked with over the years have told me their club or group at first was all for it with promises of money and help. But when it cam down to it, that help disappeared or each had different ideas about how it would be configured or placed. It usually ends up with one or two people doing all the work.

So the first thing I suggest is to plan it all out and then have everyone that is going to be involved have their part, whether it is building something, buying a part, or just giving funds, defined on paper. Discuss it all and select a systems manager to see that everything comes together in a timely manner, and a technical manager who makes sure the right components are selected and go together properly. Have each person initial or sign for his part of the project so that there is no misunderstanding months later as to who was supposed to do what and when.

Things will change over the course of the project, and as they do the systems manager can update the tasks and keep everybody informed as to progress and what is needed.

When you nail people down like this you quickly separate the talkers from the doers.

The most important decision after you have all the players is to select the repeater site. Chances are that the highest and best coverage spot already has repeaters on it by other amateurs, business, government, etc. A meeting with the site manager or owner should be set up with only the system manager and technical manager to find out the rental costs, are there U.S.A.. Forestry or BLM permits also required, what are the frequencies and power output of other systems that might be of interference potential, site access restrictions, technical requirements, antenna type and placement, coax or hard-line length, rack space, etc.

Decide if you are going inband or crossband repeat and horizontal or vertical antenna polarization. Have a meeting with your area's frequency coordination council and discuss the alternatives with them. Coordination is done by site and its area of coverage which has the most effect on interference probabilities. Keep it friendly and technical. It may take more than one meeting and some testing.

An inband will be the hardest to coordinate due to taking up so much spectrum. See page six for info about the different considerations in the 420-450 MHz band plan. Take it with you to the meeting. Remember you will need at least 12 MHz frequency separation in order for the VSB filters to do their job. I suggest 421.25 output and either 434.0 or 439.25 input.

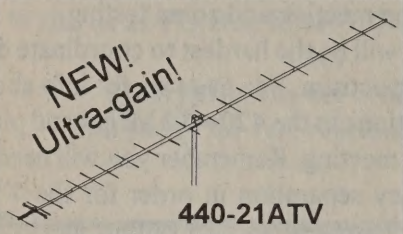
Crossband has the benefits of taking only one channel on 70 cm for an input, and leaving the other for simplex and DX. Low in and high out gives the most performance and least cost to your users because it is very easy to put a preamp at the antenna to save the higher feed line loss with frequency than a transmitter and amp. All existing ATVers will have a 70 cm transmitter for simplex and DX and will just have to add a downconverter and antenna which is much less cost than a whole new transmitter and hard line. Transmitting equipment costs go up greatly with frequency.

The other benefits are users being able to see their own video coming back for more accurate video gain, lighting, and focus adjustments and other testing when no one else is around. It is also easier to sell to the frequency coordinators. The optimum frequencies as far as harmonic relationship and other economic and coordination considerations is 426.25 in and 1253.25 out.

As you can see, there are a lot of details to be worked and planned out before the first piece of equipment is bought. I generally tell people to plan on about $2000 on the average before they have a good working machine, and not to just try to get by with what is in the junk box or could be thrown together especially if it is a shared electronic site.

The biggest cost will be for the hard line, antennas, and vestigial sideband filters. These items will be of most interest to the site owner as far as physical placement and any technical requirements. The transmitter, receiver, power supply, VOR and ID are actually the easiest to place and take up the least room.

M²
YOUR ATV ANTENNA SOURCE ...



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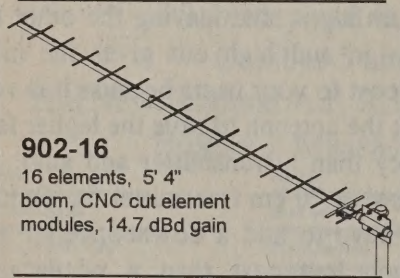
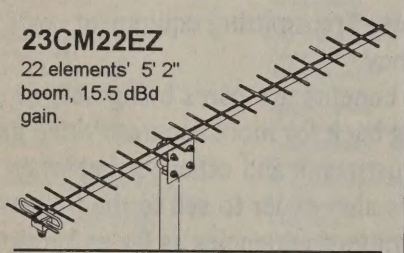
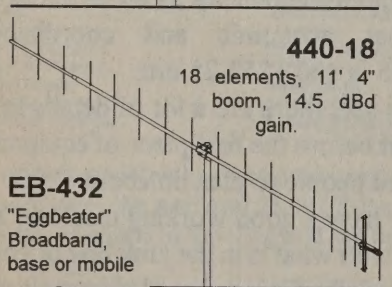


902-16
16 elements, 5' 4" boom, CNC cut element modules, 14.7 dBd gain

23CM22EZ
22 elements' 5' 2" boom, 15.5 dBd gain.



440-18
18 elements, 11' 4" boom, 14.5 dBd gain.



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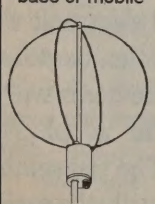

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DISC VISA

Check It Out

The next step is to make tests at the planned site to see what the coverage and interference patterns might be. I suggest two trips.

The first time to do it is when the other site transmitters are on the air, and the second when convenient to get most of the ATVers in the area on the air. I know of people who thought they had a nice quiet site when they went up to the hill top on a nice Sunday afternoon with their ATV transceiver and had no problems, but were wiped out by intermods from pagers and RCC transmitters during normal business hours. Or the one ATVer who was your best supporter has a multipath ghost or building blocking the path.

So make your tests over a long enough period of time during the peak use segments of the day that the other transmitters are operating. Get the word out to the local gang about the test hours, day, ATV frequency and 2 meter coordination talk back channel in plenty of time.

Each case of interference is unique and the cure can be equally unique such that it could take up many installments in this column itself. But most often the cause is insufficient filtering and shielding, both by the ATV system and other systems at the same site or within a few miles.

You may find some interference from other mode users quite a distance away will appear with the antenna now quite a bit higher in the air than you have at home. While frequency coordinators may give you a frequency, it is difficult to accurately predict if a distant link or repeater could be seen at your site.

Assuming the site checks out good and your potential users and supporters are happy with the signal strength from your test transmissions at the site, and you have a test coordination, you are ready to start building the machine.

Filters and Cable

The longest lead item is usually the VSB filters and should be ordered first. I suggest two good sources: TX RX Systems for inband duplexers, or individual filters, and International Crystal Mfg. for good low (1 dB) insertion loss and low cost VSB filters. These filters are absolutely necessary in the antenna lines of both the transmitter and the receiver.

Next is feed line. All coax needs to have 100% shielding both down from the antenna as well as all interconnects. RG55 double shielded 50 ohm coax is good for interconnects. While mandatory between the filters and the transmitter and receiver antenna ports, it includes short video, audio and control lines.

THINKING ABOUT PUTTING UP AN ATV REPEATER?

With the antenna line you have performance verses cost considerations. The best line to the antenna would be 1" copper hard line down to Belden 9913 depending on the length you need to run. Up to 100 ft, 9913 at 2.5 dB loss per hundred feet is not too bad. Over 100 feet on 70 cm or on 33 and 23 cm, the largest copper hard-line you can afford to keep the loss down to 2-3 dB is the way to go.

Use one continuous run and type N connectors to minimize moisture contamination or connector losses. I do not suggest aluminum hard line as the shield often oxidizes and loosens at the connectors from moisture and wind vibration (job security for many cable company maintenance personnel).

Route the cable separated from other cables as much as possible, especially the receive, to minimize crosstalk. After you verify all is well with a power meter check at both the transmitter and load ends of the cable, weather proof all outside connectors with coax seal or 2 layers of vinyl electrical tape. Secure the cable up the tower at different distances to minimize mechanical resonances that can occur in high wind conditions.

Antennas

Most all repeater antennas are intended to be omni directional. They will probably only be omni if your antenna is the one in the clear on top. But at any shared electronic site, yours will be one out of many at the antenna farm. You may not have many mounting options that would not greatly affect the antenna omni pattern.

All you can do is try to stick it out 2 or more wavelengths from any other metal supports or antennas on an arm. This is another reason to know what frequency your neighbors are on so you can have the most vertical separation from those closest to your frequency.

Think of the worst storm in your area you can remember, add many pounds of ice, and then solidly mount your antenna to the structure with that in mind...plus keep your fingers crossed! Support the antenna with a cross arm not only at the bottom, but an insulated one at the top.

When the repeater antenna and coax is installed, it is not a bad idea to check out the coverage again, just to see if the mounting didn't happen to put a null right toward the meanest most vocal ATVer in the area. Moving the mounting a few inches can often change the pattern to a new set of conditions.

With all omni antennas, vertical or horizontally polarized, the higher the gain, the narrower the vertical beam width. This could be a problem for those close to the repeater if the site is 500 ft or more above the average terrain. The cure would be a down tilt antenna (usually the resonant length is just above the transmitting frequency for the down tilt) or a lower gain and therefore broader beamwidth antenna. Antenna placement again could be the cause by putting a null right at the wrong guy (another one of Murphy's laws). You generally want the highest gain at the horizon in the vertical lobe for DX. The signal is usually still quite strong close in such that the vertical lobe gain roll off at large angles below the horizon will still give a snow free picture.

Commercial sites may require more rugged commercial antennas than the usual amateur types. Telewave, Sinclair, DB Products and others make 70 cm 6 to 10 dBd broadband exposed dipole type vertical omni antennas for single antenna and duplexer systems. Diamond has a 9.3 dBd vertical stick (F-718) with 3 models to cover 10 MHz segments of the 70 cm band at a relatively low price. These are good for 2 antenna inband systems. Lindsay makes the TZU zig zag horizontal omni for 70 or 23 cm with 4.5 dBd gain and they also have a new 8 bay 70 cm version with 9 dBd. Olde Antenna Lab has Big Wheel horizontal omni which in a quad array gets 6 dBd. The Comet FP1933 cm has 10 dBd vertical gain. The F1230 has 11 dBd on 23 cm.

Frequencies and modules will vary depending on inband or crossband repeat. Inband may also use a TX-RX Duplexer to one braodband antenna instead of two. The Video Operated Relay is put in its own CAB247 box with an Elktronics video ID board, not in the receiver or transmitter box. The high current power amp must have its own power supply.

OK, you have checked out the site, coordinated the frequencies, gotten the antenna(s), feedline and filters, now for the fun part, the repeater itself.

Repeaters tend to evolve and change over a few years so a modular approach makes much more sense than putting it all in one chassis or enclosure. It also allows changes and additions to be made easily without having to make many trips to the hilltop to bring the system down to the bench for major surgery. One trip to the hill to sub or plug in a small module also saves the wrath of the flock that have no patience for down time.

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To start, there are 3 basic active modules: the transmitter, the receiver and the control/ID units. See the block diagram. Each should be mounted in it's own completely shielded box with appropriate coaxial connectors for interconnection. They can be bolted to 19" panels if they are to be put into a rack at the repeater site.

I like the LMB CU 247 diecast aluminum boxes, but there are others that have complete contact along all seams. The shielding is absolutely necessary to keep your transmitter, and any others nearby, from desensing the receiver. You would be surprised how RF can get through cracks in chassis and less than 100% shields in coax.

It is possible to shield and filter effectively. I have seen interference free weak signal video at repeaters sharing the same building and antenna structure with five or more 70 cm FM repeaters with associated links and control, and even some with megawatt UHF broadcast TV stations.

DC lines can be fed through the chassis with 500 to 1000 pF feed through caps. Audio and video lines should be coaxial connectors with bypass caps mounted right at the connector with as short of lead length as possible. I use 220 pF for audio lines and 100 pF for video lines. Do not use beads on video lines.

I suggest double shielded or aluminum foil + braid coax for all interconnections. Any lead that is not 100% shielded and bypassed at the connector is likely to become a poor but significant antenna to conduct unwanted RF into the box.

Transmitter

Careful attention must be made to all RF internal connections as well as connector assembly. Any VSWR in the transmitter that makes the reflected energy travel on the outside of the coax and over every nook and cranny of the box can eventually reach the receiver.

Many do not realize that a good VSWR reading outside of the transmitter box does not mean that the interconnecting coax from the transmitter board to the chassis connector is good. Coaxial integrity in the receiver is also important to keep unwanted ground currents from sneaking inside.

So keep the RF inside the coax as much as possible with very short center conductor and shield leads. It does not make much sense to pay the bucks for a good quality VSB filter to have it bypassed by poor shielding and construction practices.

Run RG-58 coax for the leads to the power supply to minimize pickup or radiation to or from the transmitter. You can use the same supply as the receiver if the transmitter draws 1 amp or less, but all power leads must connect directly at the power supply terminals, not to a junction strip on leads away from the supply.

Make sure that all composite video inputs are resistively terminated in 75 ohms, and that all output waveforms are 1 volt peak-to-peak with the proper bypass and setup levels at each module. Do not attempt to compensate for a shortcoming in one module by adjusting another, as it will all change as other video sources are added such as the ID, TVRO Shuttle video, links, etc.

The RTX transmitters are available along with companion amplifiers for 70, 33 and 23 cm depending on the band you want to output on. The block diagram example shows an inband repeater starting with a 1.5 Watt pep RTX-70 transmitter driving a Mirage D100TVN|R amplifier, but you could substitute a RTX-33 driving a Downcast 20 Watt amp or a RTX-23 driving the Downcast 18 or 35 Watt amp for crossband output or link.

Amplifiers

Closer attention must be paid to driving amplifiers within their linear region with repeaters than the home station. Any non-linearities, intermods, incorrect setups by the users stations will be multiplied by those present through the repeater. Another factor is the possibility of 100% duty cycle and continuous unattended operation.

For reliability reasons the D100 repeater version is purposely run at 80 Watts peak sync rather than its over 100 Watt capability. The repeater version is constructed as a 19" rack panel that is all heat sink.

But more important, the sync tip is set to not exceed 80 Watts so that the sound subcarrier riding on the sync at -15 dBc has the head room to swing just up to but not exceed the 100 Watt peak level. If the sound gets squashed on the sync tip, there might be some audio buzz added. Likewise, the video gain must be set not to exceed 10% power swing on the white areas.

Intermod generation goes up at higher power swings which raises the sideband noise and video modulation products such that the VSB filters will not be able to reject them enough to keep them out of the repeater

receiver.

Also it is desirable to run the color burst down at a level that does not get too far into the amplifiers compression level. If each amplifier starting at the user's transmitter and amp up through the repeater's receiver and amp compresses or rolls off the color burst a little, it will add up to loss of color on all but the strongest stations.

So it is better to under drive a repeater amp than over drive it for many reasons. If need be in the case of over drive, the insertion loss of an additional bandpass filter, fixed coax attenuator or long length of double shielded coax can be used at the lowest level to insure linearity and reliability.

The RTX transmitters 1.5 Watts pep will properly drive the recommended amplifiers without attenuation and near peak power capability. But if the TXA5-70/PA5 10 Watt module system is used to drive a Mirage D1010ATVN-R, follow the final amp p.e.p. output and pedestal setup procedure to drop the power down to the linear range. The adjustments are on the TXA5-70 board. A Spectrum International VSB filter between the PA5 and D1010NR is required for a single antenna inband system with duplexer for additional desense prevention.

Air should be blown across any repeater amplifier fins even if rated for 100% duty cycle to insure that heat does not build up especially in a cabinet.

The Mirage repeater amplifiers do not have any filtering on the 18.3 Vdc power leads. They can act as antennas to pick up stray radiation inside the amp shield and reradiate it outside to cause receiver desense. You can wrap foil around the leads to help minimize radiation, or better yet is to mount a SO-239 connector on the chassis after punching the red lead hole out to 5/8" dia. and drilling 4 holes for the flange mounting screws. Sand paper the anodize around the hold for good ground contact. Run the red and black wires internally to the SO-239 connector and add some 100 pF bypass caps with short leads from the center red lead pin to the ground lug under one of the connector mounting screws that has the black wire soldered to it. Run RG-213 with a PL-259 plug to the power supply. Any amp drawing more than 5 amps should have its own power supply and the leads as large and short as possible.

Receiver

All ATV repeater receivers should be crystal controlled. Even a temperature stabilized free running oscillator will slowly change frequency with age, dust accumulation, oxidation, etc. Once the machine is up and operating well, you probably will not want to make several trips to the hilltop to just tweak the LO back on center frequency.

Outputs from the receiver module should be one or two composite video and one line level audio. The receiver composite video output standard is 1 V peak-to-peak into 75 ohms just like it is for cameras and other video devices. It is handy to have one video output to go to the transmitter and another one to go to a local monitor to aid monitoring and adjustment while at the site. It could also go to a crossband repeat or link transmitter.

The line audio is also about 1 volt peak-to-peak but operates into a 10K high impedance or 600 ohm load. Another nice feature is to have the audio squelched to keep the audio noise down with the weaker video signals that can key up the horizontal sync operated relay but are not strong enough to quiet the sound. A local speaker amp is also of benefit for monitoring at the site. The ATVR series of receivers have all these features.

Especially for an inband repeater, a separate power supply from the one used by the transmitter must be used if the transmitter draws more than 1 amp. There could be some conducted interference on the common power supply lines, and the final amp varying load with video modulation could set up a feedback path through the receiver. Run RG-58 coax for the power lead directly to the power supply terminals.

I recommend single frequency conversion directly to the standard 45.75 Mhz TV IF as in the ATVR receiver rather than to a channel 3 TV receiver. A channel 3 receiver has a free running LO that can drift, and also more possible system mix and image products from strong nearby transmitters.

The 45.75 Mhz TV IF SAW filters are made to favor the lower vestigial sideband. To properly receive the standard upper VSB, the local oscillator in TV tuners is above the receiver input frequency to invert the VSB. So, if you have a downconverter for channel 3, it is not just a simple matter of moving the local oscillator up to 15.5 Mhz to output on 45.75 Mhz instead of 61.25 Mhz. It actually has to be moved up to 107 Mhz.

Many new repeater receiver systems start out having way too much system gain which ends up being swamped by the stronger ATV stations and makes it more susceptible to intermods and desense cycling.

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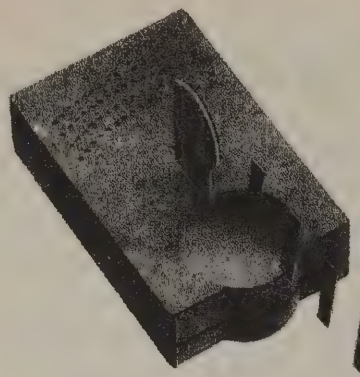

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Total receiver gain should be just enough to start the video AGC voltage to move on noise. Any more gain does not improve sensitivity, it just pumps up the AGC with the amplified noise floor. Adding preamps ahead of a good preamp in the downconverter most often does not improve sensitivity but rather gives more intermod interference produced in the overloaded first mixer or following stages.

To check your system just measure the video IF AGC dc Voltage, not the RF or delayed AGC, with the downconverter turned off and then see if it changes much when turned back on. Ideally the voltage change should be slight, assuming no signal input and properly terminated.

The noise floor in most TV receivers is no better than 1 microvolt due to the noise power floor with the 3 Mhz 3 dB bandwidth of the video luminance amplifiers to minimize intermod with the 3.58 Mhz color amplifiers. The preamp stage should have the best noise figure device possible to get as close to the 1 uV as you can. But you may have to dump some gain with resistive attentuation between the downconverter and the receiver to also have wide dynamic range.

You want to get the weakest signals, but at the same time be able to accommodate that guy 2 miles away who won't turn off his 100 Watt afterburner and wonders why the repeater picture is rolling and distorted from clipping. The RF or delayed AGC which controls the preamp gain is set to start between 150 and 200 microvolts. This level is considered snow free for Amateur purposes.

ID and Control

FM voice repeaters key by means of a carrier operated relay from limiter current or squelch, or by sub-audible tone (CTCSS) decoder. The same can be done with ATV, but with the wide band nature of video and all the other modes that can get into the passband, a video operated relay is more commonly used.

A video operated relay (VOR) looks for valid horizontal sync out of a sync separator. The probability of false keying from radar, voice or digital modes is low since the signals must first go through a sync separator and then a tone decoder at 15734 Hz. To further protect form unwanted signal capture, a time delay of a second or so of valid horizontal sync can be designed in before keying the actual relay that applies the voltage to the transmitter exciter. DC power to the final amplifier is left on at all times.

The PC Electronics VOR-2 board has a transmitter exciter B+ relay, timers and another relay for

THINKING ABOUT PUTTING UP AN ATV REPEATER?

switching between the received video and a video ID or to key a MCW ID (Comm. Spec. ID-8) on the sound subcarrier or video carrier to meet legal requirements. You must identify with legible letters in the video or by audio within every 10 minutes of continuous transmission and at the end of a transmission (97.119).

While the FCC rules used to say that a repeater must turn off within 5 seconds, it was a common practice before as is now to keep the video ID and repeater transmitter on for 5 to 30 seconds after someone dropped their transmitter in order to have some video signal to tune their receivers or align their beams to.

Some illegally have video ID or other locally generated video turned on by anyone's two meter tones. FCC rules forbid primary control below 220.5 Mhz. One possible way around that is to also repeat the 2 meter audio on the sound subcarrier in which case it is a crossband repeater in the same mode and the video secondary.

Turning on the transmitter with video ID by a timer with no one inputting to the machine (auto-jam mode) is also illegal. These are grey areas that are usually not challenged but, you as a repeater owner, should be aware of them.

Some Whistles and Bells

Once the basic machine is up and running, the real fun begins by adding some additional functions.

Mixing in the local 2 meter ATV calling frequency at about half the incoming ATV sound level helps everybody hear those that are on opposite sides of the hilltop or too far away for normal 2 meter simplex communications or for repeaters that are not co-located.

This is easily done through another 10K pot and series 10K resistor and 1 mF cap to the same negative opamp pin of the line audio input. That's pin 2 on the TLO82 in the FMA5F and KPA5F, and pin 6 on the older RTX-70's. Actually, you can add 4 or 5 of these mixed audios from other radios, voice or MCW ID's.

Other video sources such as the Space Shuttle, weather radar, links from other ATV repeaters, packet BBS, remote camera, etc., can be switched in by one of the many DTMF decoders on the market (1990) ARRL Handbook pg 34-3 or Comm Spec DTD-1) in place of the received video. The Motron AK-16 DTMF Controller Board has 16 relay driver outputs which should be more than enough to switch relays for various video and audio sources.

I suggest the decoder be connected to the incoming sound subcarrier to make it easy for ATV transmitting stations to use. A timer can be added to limit the on time if the user's video goes away and they forget to return it to normal repeat mode.

Two Antennas vs Duplexer

This question is asked a lot by those about to put up an inband 70 cm repeater. A crossband repeater has such frequency separation that simpler bandpass filters in each antenna line may be good enough, but an inband 70 cm ATV repeater has tough requirements.

The broadband noise out of an amp with just carrier is probably no better than 70 dB. Add to that the video source noise at 40 dB additionally rolled off by the video modulator, amp intermod and sideband harmonics and you have a lot of energy next door waiting to go into your 1 to 2 microvolt receiver.

If you have a 100 Watt amp, the peak power is 157 dB above a microvolt. Depending on what the actual transmitter noise and video sideband harmonic level are from all causes at the receiver passband, the VSB filter on the transmit antenna line has to knock all that noise and sidebands down to below one microvolt.

Also the receiver VSB filter has to knock the transmitter carrier as well as sideband power down to at least 1/10 milliwatt (70 dB below 100 Watts) so as not to overload or intermod with the downconverter preamp or mixer.

This is a tall order for a filter with low insertion loss and a flat 6 Mhz bandpass. A good quality VSB filter has 80 to 100 dB of rejection 12 Mhz away. It also mans to leakage from poor shielding or coax around the filters. The TX-RX Systems 26-66-01A Duplexer or the individual International Crystal Mfg. FL407 VSB filters do a good job with less than 1.2 dB insertion loss. But we still need at least 50 dB more attenuation to prevent overload or desense.

With a two antenna system you can do this with vertical separation. Regardless of polarization, an omni will have a minimum field above and below it. The higher the gain the greater the isolation at the same distance, since the vertical lobe is narrowed. For the old Phelps Dodge 10 dB stick Station Masters, 20 ft end to end gave about 50 dB at 450.

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If your antenna is less than 10 dBd, but you don't have much room on the tower to get added separation, try finding a magic null point. Fix the transmitting antenna at its location on the tower and transmit. Connect a spectrum analyzer or other calibrated signal strength device to the receiver coax without the VSB filter. Have someone slowly move the receive antenna up and down on the tower to find a minimum point and lock it in place.

With the TX-RX 70 cm duplexer to a single broadband antenna, another VSB filter from TX-RX or International Crystal Mfg. can be put in the line between the duplexer and amp to get the added rejection. If you have excess drive you can try putting the filter between the transmitter and amplifier, but the amplifier IM products may exceed the 50 dB requirement. In either case do not drive or over modulate, or else the sideband harmonics may capture your receiver and make it cycle between the video ID and noise.

70 cm ATV Frequency Selection Considerations

Here are some pros and cons to consider when determining the ATV bandplan for your area. Only 2 frequencies can be used for ATV without a high probability of mutual interference as well as leave plenty of space for other modes. The choice must also be made between an inband repeater with simplex shared on the repeater input or output, or a repeater input with crossband output and a separate simplex channel.

421.25

This is most used output for repeaters and requires a VSB filter in the antenna line of every transmitter to keep sidebands and final generated intermods from interfering outside the amateur band below 420 Mhz. The channel occupies 420 to 426.0 Mhz and corresponds to cable channel 57. Listed in ARRL bandplan for ATV repeater or simplex, but shared with control links and experimental. I recommend it for repeater outputs only, since the filter requirement for each user is impractical.

FM or packet links, control, etc. can then use 426.0 to 431.0 with 3 Mhz channel splits. This gives 80 duplex 25 KHz channels and 40 simplex channels or less combinations with some multiple adjacent channels used for higher baud rate or voice fidelity. Packet can use 431.0 to 431.6 also.

426.25

This is the most popular simplex or secondary channel. Half of all our transmitters sold to date have had this frequency requested. There has been least interference noted on this channel in the lightly populated areas. Most used by state and local government amateur radio emergency groups, R/C modelers, robots, and special purpose video links.

Suggested as a good crossband repeater input, however other mode users at the bottom of the band should be high in low out near the same site to prevent overload.

Sometimes used as a repeater input for crossband or when 439.25 is used as an output in active 440 FM areas.

Occupies 425.0 to 431.0 Mhz. Other modes have the same number of 25 KHz channels as listed above but between 420 and 425 Mhz. Channels at 421.75 and 422.67 +/- 200 KHz (32 NBFM channels out of the 80 possible) should be assigned last when all others have been filled, and only at which time VSB filtering would be required of those having enough LSB color or sound subcarrier power to actually cause interference.

427.25

Used in a few areas instead of 426.25 because it corresponds to cable channel 58. Listed in ARRL bandplan solely for ATV simplex, not shared. However, 426.25 was preferred to minimize possibility of the 427.25 sound subcarrier at 431.75 from overloading any nearby 432.0 weak signal or EME receivers. Today modern narrowband weak signal receivers generally have enough dynamic range and rejection. Occupies 426.0 to 432.0.

Would give 40 more 25 KHz channels (total of 120 from 420-426 Mhz) to other mode users to use as duplex or combination with simplex links. LSB last to assign and require VSB frequencies would be 422.75 and 423.67 +/- 200 KHz.

434.0

Occupies 432.75 to 438.75. Most popular switch to frequency when local FM repeaters fill in below 444.0 or use high in/low out in areas using 439.25 ATV. This frees up to 200 FM voice repeater channels from 440 to 450 Mhz. 433:25 Mhz, cable channel 59, would have been the logical choice, but weak signal users were concerned about sideband energy at 432.0. Experiments showed most energy down 40 dB and random at any one spot frequency

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2 MHz from the video carrier and 30 dB 1 MHz away. Vertical polarization also minimizes energy to 432 MHz DXers who are horizontal.

Packet repeat links would be located between 438.7 and 440.0 MHz instead of 433 to 435 MHz. Simplex packet would be at 431.0 to 431.6 Mhz.

The LSB other modes avoid frequencies til full and require VSB for those experiencing interference are 429.5 and 430.42 +/- 200 KHz. USB sound is at 438.5 and color at 437.58. I am not aware of any satellites using this 437 frequency as yet, but the color is less than -22 dBc.

Experiments with satellite users showed no interference at 435 MHz except for one within a mile with beams pointed right at each other. However, satellite uplink stations greatly interfere with video down to -40 dBc. Since satellites are not in view for very long, the convention is when the video gets hit with uplink signals, wait for 15 minutes and come back later when the pass is over.

Alternately, if the video is important, like a public service event, etc., known 2 meter calling frequencies are used to work out a temporary schedule on a gentlemanly basis. In southern California the satellite users are on 144.144 USB, weak signal operators on 144.170 USB, and ATVers on 146.43 FM.

Likewise, if there is a UHF contest, we give up ATV for that weekend, and in fact, we get on and give the contesters some points...helps change their attitude about sharing the band. They stay off during the Rose Parade and some of the other public service events the local ATVers do.

439.25

Occupies 438 to 444.0 MHz and corresponds to cable channel 60. Most popular frequency east of the Rockies for repeater input or DX simplex where UHF FM repeaters have not filled up the 40 25 KHz channels from 444.0 to 445.0 or are high in/low out. Some use 439.25 for repeater output and 426.25 as an input if UHF FM repeaters give too much interference and 434.0 is not available.

It is the only frequency available to those in Canada or above the A line per the ARRL band plan. Some have used 434.6 DSB or 434.0 VSB or without sound subcarrier in Canada. Also some repeater inputs have favored the lower VSB instead of the upper, when unable to get FM repeaters to stay above 444.0. The LSB color and sound subcarrier frequencies in this case are 435.67 and 434.75 MHz.

439.25 is listed as an ATV repeater input in the ARRL Repeater Directory 70 cm bandplan. However, 442-445 is also shown as FM repeater inputs or outputs. This is incompatible as FM will tear up a video signal if below 444 and a video signal will interfere with FM if on 442.83 or 433.75 +/- 200 KHz, the color and sound subcarrier frequencies. But this is what you get when ATVers do not take an active and technical part in the band planning and spectrum management.

Optimum FM repeater offset would be low in and high out to keep any nearby or at the same site FM transmitters from overloading the ATV repeater receiver, even with a good VSB filter. Since there is likely to be so few ATV repeaters in any given area, those FM repeaters closest or at the site should be placed as high in the band as possible. Use of CTCSS by all FM repeaters is recommended.

Crossband Repeater

The 33 cm band (902-928 Mhz) is roughly half that of the distances listed on the 70 cm table. While this makes an inband 70 cm machine look more desirable, the 6 dB difference can be compensated for with the smaller, higher gain antennas and antenna mounted preamp by the users.

A crossband repeater with its output on 33 or 23 cm, although having more path loss than 70 cm, may still be well within the antenna height RF horizons for snow free pictures within your coverage area. The benefit of freeing up the other 70 cm ATV channel for simplex and users being able to see their own video coming back is well worth serious consideration.

23 cm (1240-1300 MHz) is suggested over 33 cm in the more populated areas since amateurs share this band with many other services that have priority.

Cross-banding makes it easier to link into adjacent repeater areas. If your area outputs on 33 cm and the adjacent one on 23 cm, then all that is necessary to link is a receiver on the other's frequency. The video can be selected via tone control to repeat the 70 cm receiver or the adjacent areas repeater outputs receiver.

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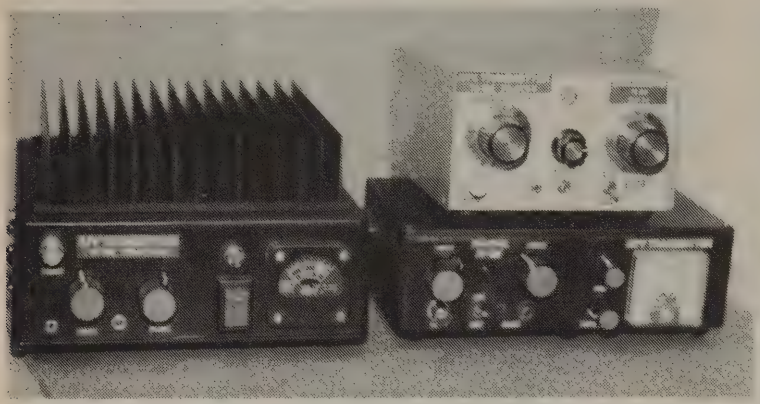

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PD-33 HP 6W=18W..... $149.00
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The 70 cm 420-450 MHz distance miles are in the order of 1/15/50/80 Watts.

XMIT	4 dBd AEA ISOPOLE	8 dBd KLM 440-6X	10 dBd DB prod. DB420	14.5 dBd KLM 440-16X
REC				
ISOPOLE	2/9/14/18	3/13/21/27	4/17/28/36	6/26/42/55
440-6X	3/13/21/27	5/22/35/45	6/26/42*/55	10/44/70/91
DB420	4/17/28/36	6/26/42/55	8/35/56/73	13/57/91/118
440-16X	6/26/42/55	10/44/70/91	13/57/91/118	22/97/154/200

Another selectable crossband receiver can also be used for special purpose links to bring in Space Shuttle video from someone's TVRO, weather radar video, or other public service event that needs to be keyed in for long periods without chance of someone accidentally coming up on the normal repeater input.

ATV Repeater DX

While it is almost impossible to predict actual ATV DX due to different terrain and conditions, the line of sight snow free picture distance can be calculated given all the controllable factors. We must know the transmitter peak envelope power (p.e.p. - sync tip), coax loss, and antenna gain over a dipole. At the receive end, we must also know the system noise figure and bandwidth. The chart below assumes the RTX70-1 transmitter, TVC-4G or TVCX-70 GaAsfet downconverter, or TC70-10 connected to a good TV set with 3 Mhz IF bandwidth, 3 dB loss in coax at both ends, and snow free defined as a carrier to noise ratio of 40 dB (about 200 microvolts).

The distances in miles are shown in the order of 1/15/50/80 Watts which is the RTX70-1 by itself, driving a mirage D15N (15 Watt), Mirage D26N (50 Watt) or Mirage D100TVNR (80 Watt) linear amplifier. To find the possible DX under line of sight conditions, find your antenna model or equivalent gain across the top. Then go down to the receive ends antenna or gain. Now read the miles that corresponds to your transmit power level.

The purpose of the DX chart is to enable you to better figure what is needed in your system to have the best chance of getting good pictures where you want them. This is especially important to repeater owners or those setting up for a public service event to figure the expected area of coverage.

The DB Products DB420 exposed multiple dipole array an example of a popular high gain broadband omni vertical that is used for inband repeaters with a duplexer or at base stations. The Diamond F-718 antenna used on two antenna inband machines is close enough in gain also for comparison. If a repeater is running 50 Watts to a DB420 or F718 omni, it could be snow free to a station 42* miles away using a 440-6X beam. The distance will double or half with each 6 dB change.

There is no accurate way to figure non-line of sight conditions due to obstructions or terrain. Different structures and foliage have different attenuations at different frequencies. I have measured 20 dB of change dropping just 5 ft below the top of a Walnut tree 50 ft from the antenna. I could still see the repeater through the leaves and branches.

Normal RF horizon if the land were perfectly flat is only 10 miles from the top of a 50 ft tower. If raised to 100 ft, it goes to 14.1 miles. If you are lucky enough to have a 5000 ft above average terrain mountain top to put your machine on, the horizon is now 100 miles. The distance in miles equals the square root of twice the height in feet. For more info, see the 1986-94 ARRL Handbook, chapter 22.

This means that the line of sight calculations are valid, assuming no obstructions, if the sum of the repeaters RF horizon and the users RF horizon are equal to or less than the distances shown on the table.

Temperature inversion ducting can make UHF signals skip almost like HF ones giving DX many hundreds of miles. However, if the repeater antenna is on a hilltop that is above the inversion layer, it can act as a lossy barrier. Best time for inversions is around sunset in early summer, but conditions vary in all parts of the country.

23 cm Snow Free Line of Sight Miles per 1/18/35/100 Watts

	omni	beam	
XMIT	0 dBd Dipole	10 dBd Diamond F1230	16.3 dBd
2424LYRM			
Rec.			
Dipole	.4/1.6/2.5/4	1/4/6/10	2/8/11/20
Diamond F1230	1/4/6/10	2.3/10/14/24	5/20/28/50
2424LYRM	2/8/11/20	5/20/*28/50	10/42/59/100

Similar to the 70 cm example, the snow free line of sight DX of a 1253.25 Mhz crossband repeater output running 35 Watts from a RTX-23 driving a Downeast amp to a 10 dB omni will get *28 miles snow free P5 pictures to someone using the 24 element, 6 ft long loop Yagi. The RF horizons would just make it if the two towers were at 100 ft each or more likely the repeater at or above 200 ft and the user at 50 ft.

If you still had line of sight past 28 miles to the repeater, you

THINKING ABOUT PUTTING UP AN ATV REPEATER?

could get P4 pictures up to twice that distance. 8 of the Southern California repeaters are crossband to 23cm with good pictures over 100 miles. The 6000' mountain range with all the repeater sites on the tops really help.

Some of the 23 cm Southern California ATV repeaters are linked to their adjacent 33 cm neighbors. The video links have been tested all the way from Las Vegas, Nevada, to Santa Barbara, California. Plans are to extend all the way up the state and out to Phoenix, Arizona.

The 23 cm band has 5 AM AT|V channels which can be used for combinations of repeaters, links and simplex. If FM ATV is desired, it will take up two of the AM channels at the bottom of the band below 1260 Mhz. You will have to work out shifting of the other mode users with your local coordinator. We suggest 1252 Mhz. With 4 Mhz video deviation and 5.5 Mhz sound, the occupied bandwidth is 19 Mhz.

Equipment Sources

Diamond and Comet Antennas
70, 33 & 23 cm beams & vertical omnis
PC Electronics 818-447-4565

Communications Specialists
ID-8 and DTD-1
PC Electronics 818-447-4565

CMC-Sinclair - 70 cm antennas
7020 Hayvenhurst Ave #E
Van Nuys, CA 91406
818-994-4455

DB Products - antennas
PO Box 569610
Dallas, TX 75356
214-631-0310

Downeast Microwave - 33 & 23 cm amps
954 CR519
Frenchtown, NJ 08825
908-996-3584

Elktronics - video ID
12536 T.77
Findlay, OH 45840
419-422-8206

Hi-Spec
100W 33 & 23 cm amps
PO Box 387
Jupiter, FL 33468
407-746-5031

International Crystal Mfg. - VSB filters
Attn: Royden Freland
PO Box 26330
Oklahoma City, OK 73126
405-236-3741

Lindsay antennas - TZU antenna
50 Mary Street
Lindsay, Ontario, Canada K9V 4S7
705-324-2196

Motron - AK-16 DTMF Decoder
PO Box 2748
Eugene, OR 97402
541-687-2118

Olde Antenna Lab - Big Wheels
6224 S Prince Street
Littleton, CO 80120
303-798-5926

PC Electronics - xmtr, rcvr, ant, etc.
2522 Paxson Lane
Arcadia, CA 91007
818-447-4565 818-447-4565 (fax)

Spectrum International - filters
PO Box 1084
Concord, MA 01742
617-263-2145

Telewave - 70 cm antennas
1155 Terra Bella
Mountain View, CA 94043
415-968-4400

TX-RX Systems - VSB duplexers
8625 Industrial Parkway
Angola, NY 14006
716-549-4700

73 de Tom O'Hara, W6ORG
Questions?
Email: tomsmb@aol.com

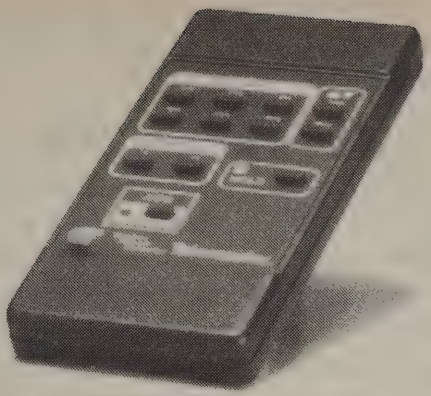
DCI FILTERS??

Hi. I was wondering if anyone has used a DCI (Digital Communications, Inc.) from Canada Interdigital Filter? The specs look good and the price is lower than ICM's. The users of the ATV repeater here in Detroit need to keep their RF above 430 Mhz (darn A-Line!). We're looking for the least expensive

San Luis Obispo

I'm in the late planning, early construction stages (VSB filters ordered so far) for an ATV repeater in the San Luis Obispo area, 434 in, 1241 out, on Tassajera Peak (2700 feet). Any thoughts from anyone? 73, Chris, KD6DSI

NEW FROM WYMAN RESEARCH INC.



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Call for the latest prices on the TSC-70. You can be assured it costs less than your 10 watt ATV transceiver.

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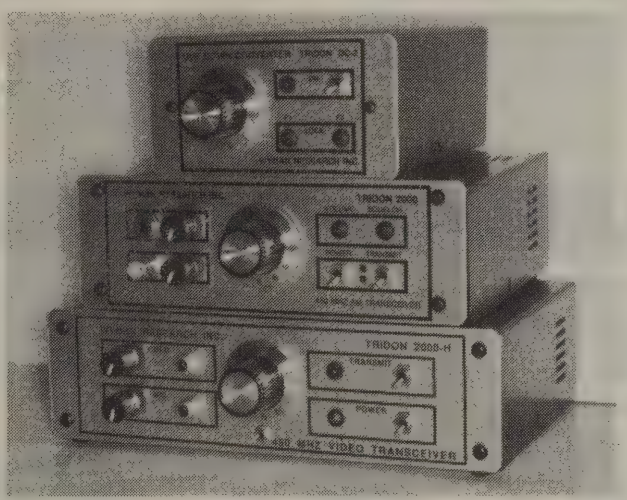

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SANTIAGO NEWS

WA6SVT

Several changes and enhancements have been made this last year. Mike, KC6CCC, has donated a 2417 MHZ link receiver module and an FM IF housed in one of his receiver boxes. Thank you, Mike! I mounted each receiver in its own 5 1/4" relay rack panel donated by Greg, N6TDZ. Thanks, Greg. I added a signal strength meter with modification to the receiver supplied by Mike, KC6CCC, to add this feature. On January 12, Dave, KA6DPS, and John, KA6HXX, and I went to Santiago to install them and service the cooling fans for the room. Dave also documented the outer loft area. Thanks, Dave and John. Two months ago Mark, WB7AJC, was at Santiago and removed the reflector on the 2441 MHz antenna and moved the antenna and converter to the top of the tower to get maximum results and minimum QRM from the new paging transmitter antennas that were mounted near the old antenna position. Mark has made several trips to Santiago. Blue ridge and Breckenridge to service and upgrade the network. Thank you for your valued efforts.

Spectrum International has informed me that they plan to ship a new designed low loss VSB filter in late January and we will be able to evaluate it on Santiago peak. If we like the results, we can get it at a special price, details at the meeting. We have received a notice from the site manager that the other Amateur systems will be moving to the loft to make room for the commercial systems as the floor is full in the main room. We built the loft about four years ago and it is in two parts: the inner loft is sectioned off and is exclusive to ATN and has a locked door, the outer loft is open. Due to more ham systems over the years installed in the building, we may have to extend the loft to accommodate them or have to squeeze our operation down and remove our monitors, etc. to make room for several systems in our room. I hope we can fit the other ham systems into the existing outer loft or get approval to extend the loft, more on this at the meeting.

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VSWR: 1.5:1 or less
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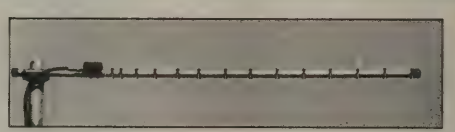
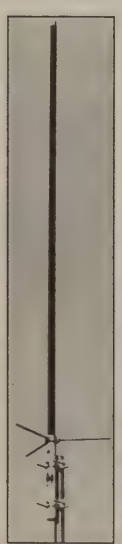
Weight: 7 lbs. 11 ozs.
Mounting Mast Diameter: 1"-2½"
Connector: N-Type
Construction: All Aluminum





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5/8 Wave x 9 1200MHz
Gain: 446 9.4dB,
1200 12.8dB
Impedance: 50 ohms
VSWR: 1.5:1 or less
Max. Power: 446 150 watts,
1200 50 watts
Length: 7' 5"
Weight: 2 lbs. 8 ozs.
Connector: N-Type
Construction: Heavy Duty Fiberglass

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Collinear
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Impedance: 50 ohms
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Length: 8' 6"
Weight: 2 lbs. 3 ozs.
Mounting Mast Diameter:
1¼-2½ inches
Connector: N-Type

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CM-900	840-950MHz	60 watts	0.2dB
CM-1200	1225-1325MHz	60 watts	0.25dB

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Connector: N-Type
Construction: Heavy Duty Fiberglass

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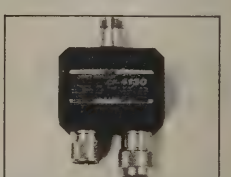

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CALL FOR THE DEALER NEAREST YOU!

Mike, KC6CCC, and Al, KF6YM, have set up a temporary link near Al's QTH to receive the output of Blueridge and microwave it to Santiago. Thank you, Al and Mike, for all of your wonderful efforts. The permanent link will be transmitted from Blueridge on 2417 and beam bender at WA6SVT QTH to relay this signal to Santiago (split site between my QTH and my neighbor's QTH). Also at this location will be a beam bender for 1253.25 the Santiago output to Blue Ridge and the Victorville area. Mike, WA6SVT, donated a complete 1253 MHz receiver and VSB filter and it is installed at Blue Ridge. The beam bender antennas are also installed at WA6SVT's QTH.

Kevin, KA6IJA, donated a beautiful rack mounted cabinet for the computer. Thank you, Kevin. Curt, N6TWB, is planning to add and interface for some telemetry of the controller and programming upgrade. Thank you in advance for your upcoming efforts. I have prepared the cabinet to house the computer and will build a DC power supply to give uninterrupted power to the computer from the battery bank on site.

The link transmitter from Oat Mt. is at my QTH awaiting a 5-watt amplifier to improve the link reliability from Oat. Sorry for the delay, but the high altitude sites had to be serviced before we got snowed out. Well that's about it for Santiago report and I want to again thank the above mentioned ATN members and also all of you who have helped over the years make ATN the best ATV system around!

!!!NEW REPEATER!!!

The old WA6SVT Santiago repeater equipment just could not be retired to the mothballs. It is now on 1289.25 out and 434 input with the call of WA6SVT at Little San Gorgonial Mt. at 9000 + feet. It is above Beaumont, CA and has coverage in the Palm Springs, Salton Sea, Imperial Valley, Inland Empire, some of the high desert, west San Diego County and LA-Orange Basin. The repeater can be turned off if necessary if a public service portable repeater needs to temporarily use the frequency for a disaster. After the links are finished to our existing network, this site will probably be linked into the network. For now, when Santiago is busy, 2.4 GHz/QSO's you can swing over on 434 MHz and have a second QSO going without cross ARM or want to explore new coverage areas. More on this at the meeting.

PALOMAR MOUNTAIN

ATV Repeater

Call sign W6NWG, Palomar Amateur Radio Club Call. Current Trustee of club call is Ron, WI6B, changing to Mike, AB6QT, as soon as paper work is returned from the FCC.

Inputs: 919.25 VSB (user switch) Touch Tone 268 on intercom frequency for AM input.

915.0 FM +/- MHz Touch Tone "C" for FM Input Audio Subcarrier 5.8 MHz.

2430 MHz FM +/6 MHz Audio Subcarrier 5.8 MHz. Note this is used for incoming link from Santiago Peak, NASA Select, and is being used as a User input when link not on until a 2441.5 User input is installed.

146.430 MHz Intercom coordination frequency PL 79.7. Note: Picture ID is activated and audio is retransmitted when Intercom is brought up for testing purposes.

Output: 1241.25 WVB P-OUT 100 Watts PEP. Antenna Gain 10 DBD.

Location: The south slope of Palomar Mountain at the 5,600 foot level. The Palomar Amateur Radio Club owns a 1/3 acre site with three buildings, a 5600 Ahr. battery backup power system, an 80 foot tower, and operates 1-6M, 5-2M, 2-1.25m, and 3-70cm repeater/nodes from this Site besides the ATV Repeater.

The current ATV incoming link site is on Murray Ridge at Sibyl's QTH. (W6GIC).

We have not decided on a final link site, but most of the equipment has been purchased for completing a two-way link to Santiago Peak. We lost the first site when a club member moved back to San Diego. A replacement site has yet to be selected and the link tower is being stored on the Palomar Club property. More information will be available after our repeater technical meeting this month.

73, Art, KC6UQH

R/C ATV HOME PAGE

This is to announce my new home page "Cyclops RPV Homepage." This home page address is "http://camalott.com/~cyclops/cyclops.html." This home page covers the construction of the Cyclops RPV System that uses ATV to pilot a large model aircraft via ATV. An early version of this system was published in ATVQ in the June 1990 issue and I did a presentation at Dayton that year where I won 100.00 award. Also published in Radio Control Modeler in Nov. 1990 issue that same year. The new home page covers the latest and greatest and has many pictures and diagrams.

Carl E. Berry, K5MWN, cyclops@camalott.com

Tracking 900 MHz Radar

Bruce Forsberg, WB6IZG
from ATN Newsletter

When I first got interested in ATV in the summer of 1994, I had two ATV repeaters to choose from. The San Diego Mt. Palomar ATV repeater (1241.25) or the Santiago Peak ATV repeater (1253.25). I first tried Mt. Palomar but a hill blocked my view of this repeater. So, I decided to try for the further (60 miles from my QTH) Santiago Peak repeater. It turns out I had a clear shot to this repeater so this is the one that I have spent my time building a station around.

In the summer of '95 after making numerous improvements to my receive setup, I was able to finally get a good receive picture from Mt. Palomar. It was at this time that I started to watch both machines from time to time. I then started to talk to some of the guys on the Mt. Palomar repeater and found out that one of the biggest problems with this machine is the interference problems on 900 Mhz. The biggest source and most disruptive was one source that would come on and stay on for days at a time. It looked as though it was some kind of radar. I decided to see if I could determine what and where this source of interference was coming from. After talking with the guys on the air, they felt that it must come from T ship based radar as the direction would be different at different times. Also, I tuned to the frequency of the radar with my ICOM R-7000 and listened. I could determine by watching the S meter peak, that the scan rate of the radar was about 5 seconds. Also, the ATV pictures would have 2 consecutive scan lines blanked out, so we know the pulse width of the radar would have to be about 130 microseconds.

Working for an aerospace defense company, I wondered if there was any information that my company might have that would help locate different radars. I headed for the company library. The most known source of this kind of information would be "Jane's," which lists just about every kind of military hardware. Unfortunately, my company does not subscribe to this. But my company does subscribe to a clipping service.

A clipping service will send you information on any topic you choose. They subscribe to almost every magazine, trade journal, newspaper and company annual reports. They then sort through this information and send you the information you are interested in. They also compile books of data on selected topics. One such book that we had was about currently in production military receivers and transmitters, including radars. I searched through this book from a company called Military Electronics Briefing looking for the data we already knew about. I found a match. It was listed as a NAN/SPS-49 Surface Ship Air Search Radar. It also contained data about the radar. Such as:
Band L Frequency 851-942 MHz, Peak Power 280 K ,PRF 280, 800, 1000 pps, Pulse width 125 microsecond
Range 250 nm, Scan Rate 6, 12 rpm, Manufacturer - Raytheon Company

Even though I was pretty certain I had found the culprit, I decided to try another independent route. I posted a message on the internet to see if anyone else knew of any radars at 900 Mhz. Most replies I received back told me that our most likely source of interference was from a new car alarm system. But we had already eliminated this. We knew it was a radar. But, I did receive one response from a gentleman who said that most of the responses I was getting were incorrect. He correctly identified the source as an SPS-49 radar. He also went on to say that Southern California probably has the largest concentration of them in the world.

From there I turned over the information I had received to Art, KC6UQH, the president of the Palomar Amateur radio club. He has in turn contacted the Navy to see what can be done in regard to peaceful coexistence. But, if you look at a spectrum chart, the frequency range that this radar operates in is filling up with pagers and cellular phones so 900 Mhz is about the only place left. And the radar is not going away, so only time will tell if this will be an on-going problem for 900 Mhz users here in San Diego and at port city locations.

Breckenridge Repeater WQ6I

This repeater is in the northern most link in the ATN network, located in the Greenhorn ranger district of the Sequoia Forest. The input is 434:00 Mhz (AM) and the output is 1277.25 Mhz (VSB).

Currently covering Kern county, this repeater's importance to ATN is as a link to northern California. The plans call for linking to Mt. Oso then to Mt. Diablo in the Bay area. In November, WA6SVT, Doug Law and I made a trip to the site, installed a new eprom with WQ6I on it, added a larger dish antenna aimed back to Blueridge which gave a great picture. We did not finish implementing the improvements planned...it was very cold up there and by 11:00 pm we had all we could take. I have delivered to WA6SVT a 1/4 db filter (PSF 1280), a VOR 2 board, ATVR 12 IF receiver xtal, coax and a Conifer 25T-2400 dish to be aimed at Mt. Oso, 187 miles away.

If the ATN network decides to maintain this site...1996 should be the year that we see the whole state of California...if not, we have state-of-the-art equipment that can be used at another site.

Flea Power International DX on 10 Ghz

Reports of DX ATV contacts are getting commonplace these days, writes Andy Emmerson, G8PTH, but here's one with a difference. It concerns a spectacular contact, or rather set of contacts, between England and the Netherlands. Nothing spectacular in that, I hear you say, except that this was with P5 pictures on 10 Ghz...and without a lift! In fact, it may change your whole perception of the 3cm band and its possibilities. Why waste time struggling with expensive power devices on 70cm and 24cm when you can achieve perfect contacts on 3cm with flea power?

There's got to be a catch and, yes, there is if you want to see it that way. But, just as a bottle can be either half full or half empty, depending on your view point, I think the opportunities presented on this band are the most exciting thing I've heard in ages. See for yourself anyway...

The catch...oh yes, the catch. Well, you need an over water path, but it can be a lengthy path. Then, if conditions are right (and remember, you don't need a tropo opening, merely calm weather) then you too could work international DX over paths up to 300km or more. Is this special pleading? I think not.

August Event

The actual contacts were made over the weekend of 19/20 August of this year (and were set up by letter a couple of weeks beforehand), but the genesis of the idea goes back to meetings at several BATC conventions. This is where Bob, G8OZP, met Hans Dekker, PE1ECO, and his colleagues who visit our ATV meetings regularly. They conceived the idea of trying ATV on 10 Ghz across the North Sea under normal conditions.

The hook up in August involved Bob located on the sea at Aldeburgh, Suffolk and Hans, who was on the foreshore at the northwest tip of Walcheren, the most westerly point of The Netherlands. Note that neither of them was on an elevated position (this is crucial); both Bob and Hans were at the top of the beach, barely above sea level.

Bob's transmitter was a DRO-stabilized affair producing 900mW on 10.278GHz into a 3ft prime focus dish. His receiver was a converted satellite LNB and homebrew electronics. For his part, Hans had a similar receiver and 250mW of transmit power on 104GHz to a 75cm dish. Several other hams joined in the QSO on the Dutch side, including PAVHF and PABOJ.

Surface Ducting

Bob says signals in both direction were absolutely rock-steady P5, exploiting the propagation mode of sea surface ducting. It appears that the signal is launched into a layer of air just above the surface of the water; the duct is formed by the changing air density caused by water vapor just above the sea. Signals enter this duct, graze the sea surface and are retraced back into the duct, rather like the action of a stone skimming on water. The height o the duct is not very great; Bob and Hans noted that passing ships interrupted their signals and in the end they could predict visually when their signals would be lost due to "action at sea." This proves that ducting is not taking place in the upper atmosphere.

Height, which is normally an advantage in VHF and UHF work, is in fact of no help with this mode of propagation. Bob also worked PE1DCD/P stationed atop sand dunes at the Hook of Holland and received signals were noticeably noisier despite similar transmit power over there.

Signal levels were remarkably constant over the weekend; tests were carried out from 10.00 to 18.00 on Saturday and from 10.00 to 16.30 on the Sunday. The sea was quite calm and Bob now wants to repeat the experiment under rougher sea conditions, although he fears the results will prove contact impossible. "This is real amateur radio," says Bob. "The theory may be well known, but at least we were able to prove it in a practical and very real manner."

Just For Fun

To provide a bit of variety, Bob and Hans also tried out some QRP experiments. Bob brought along a 10mW Gunn diode transmitter that he makes available as a kit (see footnote) together with the prototype of a new kit-built receiver. Solid P5 pictures were achieved even at this low power level! "By Sunday afternoon we were running out of new things to do," continues Bob, "so just for fun I removed the dish antenna and pointed the wave guide feed along towards Holland. Amazingly Hans could still receive my pictures at strengths from P0 to P5, albeit with heavy fading. But at this stage we really did run out of things to do!"

Because of the wide frequency split (10.278 and 10.4Ghz) they were able to pull off one other stunt, namely simultaneous full-duplex working and loop-back (with Bob re-transmitting Hans' signals to Walcheren). The path was 145km or 290km for the round trip. Needless to say, all this was achieved with P5 signals and no problems. Operation was also tried on 24cm, with Bob sending 15W. Results were nowhere near as good as 3cm, with signals of P3 to P5 strength and much fading.

You might be thinking that working ATV from the UK to The Netherlands on 10GHz was a first...but that

it's not. In fact, it's interesting to note this was achieved by Paul, G8IXE, and Ken, G4ALN, back in the late 1970's. Exactly how and where, from and to, I must investigate, also whether they too exploited sea level propagation. The sea level technique also works at lower frequencies, although possibly not so effectively owing to the longer wavelengths. I recall French hams used to transmit 70cm pictures to us Brits from the dunes at Dunkirk with great success; perhaps they still do, but we haven't had any reports of this.

Note:

Bob is making available kits of parts for his equipment designs; the GunnMod. 2 transmitter costs just $30 or $45 with a pre-tuned Gunn oscillator, while the receiver will work out around $100 (postage extra). For details send international reply coupons or one dollar bill and your name and address to Bob Platts, G8OZP, 220 Rolleston Road, Burton on Trent, Staffs., DE13 0AY, England.

I'LL BET FRED NEVER LOSES HIS TEMPER WHEN YOU TWO BICKER LIKE THAT ON ATV!

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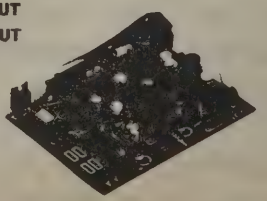
ATV900FM	900MHZ EXCITER BOARD	- $169.00	10 MILLIWATT OUTPUT TO DRIVE ATV900 AMPLIFIER
ATV1200FM	1200MHZ EXCITER BOARD	- $169.00	10 MILLIWATT OUTPUT TO DRIVE ATV1.2GHZ AMPLIFIER
ATV400DNC	70CM DOWNCONVERTER BOARD	- $99.00	INCLUDES TR SWITCH
ATV900DNC	900MHZ DOWNCONVERTER	- $119.00	-95 DBM SENSITIVITY
ATV1200DNC	1.2GHZ DOWNCONVERTER	- $119.00	-95 DBM SENSITIVITY
ATV900AMP	3 WATT AMP BOARD FOR ATV900FM	- $149.00	10 MILLIWATTS IN EQUALS 3 WATTS OUT
ATV1.2GHZ AMP	3 WATT AMP BOARD FOR ATV1200FM	- $149.00	10 MILLIWATTS IN EQUALS 3 WATTS OUT



CALLS ACCEPTED AFTER 6PM PHOENIX TIME. SPECIFY FREQ'S 426.25,427.25,434.00, AND 439.25. ONE FREQ INCLUDED. EXTRA FREQ/S $16.00 EACH. INCLUDE $5.50 FOR SHIPPING AND HANDLING. AZ RESIDENTS ADD 6.7% SALES TAX. CHECK OR MONEY ORDER.

Red, White & Boom! *from ATCO*

Amateur radio has a long tradition of providing a public service in times of a disaster and as routine public service. As an example, WA8RUT/8 went on the air just 6 hours from downtown Xenia after the 1974 tornado(s)! leveled the two and handled over 4,000 health and welfare messages. This effort was in direct support of the American Red Cross and organized by the Amateur Radio Emergency Services (ARES).

Today the Local ARES is very active and provides public service communications for a variety of agencies and non-profit organizations almost every weekend of the year! I believe we owe a great debt of gratitude to these dedicated hams in not only the public service they provide, but also being one of the strong reasons why we enjoy the Amateur Radio privileges we have today.

John Chapman, WB8INY, (area Director for the ARES) contacted me in mid-June to ask if ATCO would be interested in providing video surveillance of the Columbus, Ohio 4th of July celebration called "Red, White & Boom" for the Columbus Police. Red, White & Boom attracts a crowd of over 700,000 people for the all afternoon event ending with one of the largest display of fireworks in the nation. After a discussion on the following Tuesday night net, I called Sgt. Art Baker, the Emergency Operation Center (EOC) coordinator and arranged for Art, WA8RMC and myself to visit Police Headquarters to review the request and plan.

Basically, the need was to provide some "eyes" for the police command center located in the EOC at Police HQ. Although there were over 200 police officers dispersed in the crowd, it was still difficult for the event commander and Chief of Police to understand what was happening with street officer descriptions alone. We agreed with Sgt. Baker that two camera locations would cover the area the police were most interested in. The two locations were on top of the Gas Company parking garage and the top of the nine story police HQ building. Set up of our equipment began the afternoon of July 3 and video coverage lasted until 11:30 pm.

The ATV System for the Event

Bob, KF8QU and Art, WA8RMC were set up on the Gas Company Parking Garage (along with TV Stations 4, 6 and 10!). The station consisted of one camera, a 910.25 transmitter and a 2 meter rig. We uplinked the 910.25 signal to the ATCO repeater and watched the output of the repeater on 427.25 Mhz in the EOC. From this location, the crowd density on Civic Center Drive and the Town Street Bridge was easily monitored. The second location, atop police HQ, were hammed by Phil, N8LRG, Tom KA8ZNY and part time by Ken, WA8RUT. The system on top of the HQ building was five cameras to a video auto-switcher transmitting on 439.25 Mhz and received direct in the EOC nine floors below us. The five cameras were focused on different locations and sequenced at about a 15 sec rate. If something was of particular interest to the Chief or the EOC commander, WA8RUT or WB8INY would simply tell the roof crew (via 2 meters) to lock on a particular camera number. At the EOC were two ATV monitors, a 19" set tuned to Cable Channel 58 for the repeater output and a 13" Craig with a PC Electronics downconverter tuned to the 439.25 roof station. Originally we were going to watch the 9o10.25 transmitter direct, but it was near impossible to put up any antennas in the police EOC. "Rabbit ears" and a mini-wheel were the best we could do. Fortunately, the ATCO repeater performed very well! Next year we will plan a little better for EOC antennas.

System Performance

All of the signals were P5 with very good video coverage. We were a little concerned that the telephoto and night vision capability of our cameras would not be very useful, but these concerns turned out to be unfounded and good to great quality video was provided after dark. Phil's Sony HI 8 camera wins the prize for the best color video after dark. The little HI 8 provided mid-day quality video of the Broad Street Bridge located 1/2 to 3/4 miles away. Sgt. Baker, the Watch Commander and the Chief of Police all commented to me personally that the video was much better than they expected and, in fact, asked if we would consult with them to help the Police set up a similar capability. I don't know of a frequency that the police could license to duplicate our efforts. If anyone knows of one, please let me know.

The Bad Guys

The event itself was relatively uneventful from a police action point of view. We covered two events, one of which were people trying to cross police barricades on the closed bridges. The police at the site could handle a few people trying to cross, but if hundreds were "storming" the bridge, re-enforcements would be necessary. Our video kept a close watch on the situation. The other event was some "gang-bangers" pick pocketing (about 10 of them) and working the crowd in full view of our cameras! This is an event that I could not see taking place (all I could see was a Sea of People!), but the Police watching the monitors could see them! They were all rounded up in short order. The most tragic thing that occurred was a police officer who was run down by a leaving motorist while directing traffic.

ATVQ CATALOG and SUBSCRIPTION FORM

I am not enclosing the usual color catalog in subscriber copies this issue.
So here is what is left in the vault of treasured publications:

ATV Secrets VOL I. a 100 page beginners book, non technical, answers all those FAQ's.
Less than 500 copies left. $8.95

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IMPORTED BOOKS:

Slow Scan Explained by Mike Wooding G6IQM. Simply the best book on SSTV around today.
Less than 15 copies left $16.95

The ATV Compendium from BATC. A great technical book applicable to UK and US systems
Less than 25 copies left $16.95

An Introduction to Amateur Television by Mike Wooding G6IQM. Another great technical book with projects useful to UK and US (PAL.NTSC) TV hams. Less than 25 copies left. $16.95

POSTAGE: 1 book $3.50, 2-4 books $4.50, 5-up UPS ONLY

SUBSCRIPTIONS:

CQ-TV, the quarterly ATV publication of the BATC 1996 rate $23.00 for all 1996 issues

VHF Communications, a great quarterly publication for VHF-UHF, SHF, Microwave and ATV
1996 rate $29 for all 1996 issues.

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A New Way To Enjoy ATV Dxing

Don C. Miller, W9NTP

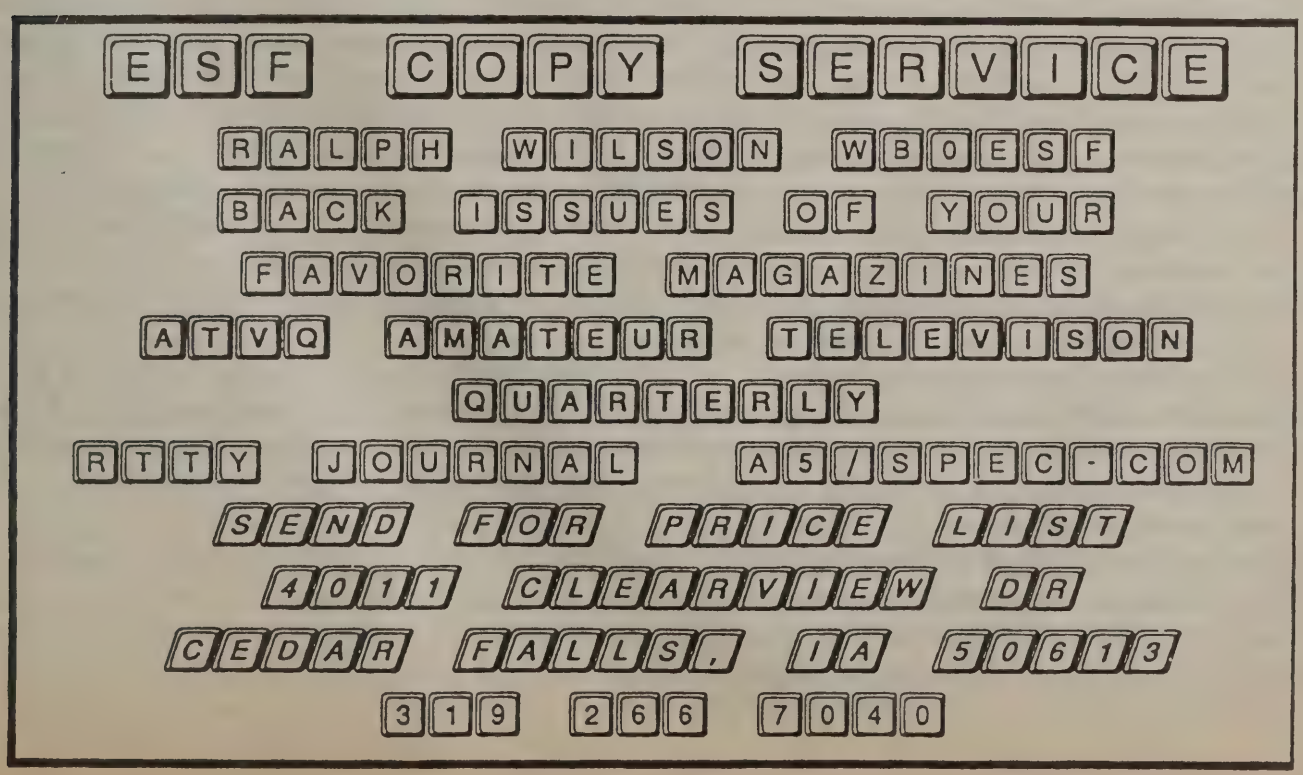
Most ATVers today can hardly wait until an ATV repeater is erected near their home. If you are like me, you eventually got tired of the same video camcorder pictures from ham vacations every night and looked elsewhere for more exciting ways to spend your ATV time.

I got started in ATV in a different way. I started ATV Dxing back in 1952 after visiting England and saw the great things that the British hams were doing with their home made equipment. During the last forty four years I have never grown tired of working ATV DX. Several of us in the Ohio Valley have found out that the best propagation time is at sunrise. Stations 100 miles away can sometimes be seen with P5 pictures. We are not interested in transmitting programs over these distances. We are trying to work stations farther and farther away with our equipment so we can do a little bragging. It is a lot like working DX on 20 meters. We are happy to just identify the call letters of the distant station. We take photographs of these flickering images with fixed video cameras or camcorders which photograph the TV screen to verify the call letters because VCRs go crazy on these weak varying signals.

I have always found it fascinating to get something for nothing. ATV transmitters that have "carrier audio" as well as subcarrier audio are getting something for nothing. This works because the video carrier frequency is varied slightly by an audio signal. This is always done in homemade ATV transmitters. Several manufacturers of ATV equipment also have this capability.

Since the deviation of the "on carrier audio" is only a few kilohertz and the ATV signal is amplitude modulated on the carrier, only a mathematical purest would see fault in doing this. You never see the audio on the ATV picture and the voice comes through a thousand times stronger than the video. The reason for this comes from a comparison of bandwidths. The video modulation consumes at least 3 Mhz and the audio consumes 3 Khz. Physics tells us that this makes a thousand times difference.

The only problem with sending audio this way is that the TV receiver has no way of demodulating a FM carrier signal. You really need a narrow band FM receiver, your handheld for instance, to hear this great advantage. Some receivers like the Icom R7000 can do this with one receiver. Throughout the last forty years, many of us have come up with clever ways to fool the TV set into thinking that there really is a subcarrier signal present. This is done by running a grid dip meter on a frequency 4.5 Mhz away from the 439.25 Mhz signal. These two signals mix and create the subcarrier that the TV set is looking for. This works well if



you have good control of the frequency and amplitude of the mixing. The disadvantage of this setup is the wider audio bandwidth in the TV set, 25 Khz instead of 5 Khz.

Recently a commercial piece of equipment has been introduced that can be used with your ATV station to get perfect identification of the distant ATV station almost under any kind of band conditions. You can, in fact, see pictures that equal living room TV while you are looking at the fading, jumping, interference prone ATV picture on your TV set.

I am speaking of the new TASCO TSC-70 SSTV scan converter. It is so small that you can hang it from your belt or put it in the car. It is a SSTV box that runs from 12 volts. Your camera can feed video to both the TSC-70 as well as to your ATV transmitter simultaneously. The audio SSTV signal can be plugged into the audio input of your transmitter. The receiving station with similar equipment or other SSTV equipment can receive perfect pictures. A computer is not needed which is unlike many other SSTV systems. The unit is so small that there are no knobs on it. It is controlled with a remote IR handheld unit.

This tremendous advantage comes from the narrow FM carrier modulation by the SSTV signal compared to the wider bandwidth of the ATV signal. If you do not have "on carrier" capability, your 2 meter transceiver works equally well. Just plug the Tasco into your mike jack or arrange a switch to go from mike to the TSC-70.

Below is a block diagram that shows how this equipment can be integrated in a simplex ATV DX station. Remember that no one hears the SSTV signal on the carrier except those who are looking for it. A narrow band audio receiver hears no interference from the ATV signal. If you hear the sound of slow scan on 439.25 Mhz, you might expect that there will be slow scan on 439.25 Mhz, you might expect that there will be a FSTV picture showing up in an hour or so. I hear ATV carriers out of the Chicago area sometimes without being able to lock to them. It is a shame that their carrier is not modulated with a perfect picture in the SSTV mode.

FOR SALE

3M #101 Video Vertical Interval Bridging Switcher. Inputs: 10 channel Hi Z loop thru video/mono audio Outputs: dual buffered video/1 ch buffered audio Fully remote controllable, optional batter B/U Cond. Used, Clean, Tested, W/rack mount and Instruction/Service manual $100.00 Call Jim KC6SOE @ 510-432-3220

ATV Round Table

Horace Bushnell W5TAH

The WATS weekly Round Table continues. We meet on the ATV repeater at 8:30 pm every Tuesday night. It is a good place to relax and visit with other folks who share the same interests in our hobby. We compare lighting, audio, ideas, cameras, lies, pipe dreams...all that stuff. We usually spend about 40 minutes on the air.

At this time, there are nine (9) ATV transceivers on the air in this area. At least, there are nine hooked up and ready to transmit. Now, if we can just get all those into action. Equipment of this sort seems to work better when the switch is in the ON position! Maybe we can get the manufacturers to start installing beepers on ATV equipment: to BEEP occasionally, reminding the owner of its presence and its need to be fired up!

Also at this time, in addition to the 902-928 Mhz downconverters that sit alongside the above mentioned transceivers, there are fifteen (15) downconverters owned by ATV viewers. Of these 15, 12 are known to be installed and operating. One of these is located in the Brazos River bottom, west of Gholson and across the Brazos River from Patrick. It is almost amazing that Howard Fruend (K5KMN) can receive the 900 Mhz repeater at that location! Another surprise is that Robert Fedro (KB5UTT), who works for the Falls County EMS, has a downconverter and is receiving a P3 to P4 signal in Marlin! He is awaiting the arrival of a mast-mounted preamplifier to upgrade to a P5 signal. So, we shall soon know how much help a preamp will offer.

Remember: The ATV Roundtable is NOT A NET and it doesn't belong to anyone. It is just a fun thing. So if you can transmit, please do so. And if you only have receive capability, by all means watch and talk to us on 144.34 Mhz Simplex.

R/C Receiver Applications Note

Also appeared in July 90 issue of ATVQ Magazine

Please read before flying the ATV transmitter

Choke Your R/C Receiver

R/C model flying with ATV aboard is bringing in new hams from that hobby. However, putting a 1 watt ATV transmitter right next to an unshielded 50 or 72 Mhz R/C receiver with little or no front end selectivity can spell disaster. It may work fine up close, but as soon as the ship gets out a little ways, the R/C signal gets weak enough that the ATV transmitter's energy captures the first mixer and down goes the aircraft.

This problem is much like those of us who, when we first got on ATV, had our 2 meter antenna too close to the ATV antenna and one interfered with the other. Likewise those who have fought desense problems with an inband ATV repeater know how important shielding and front end filtering are.

Of course the R/C receiver was not designed to operate with a 1 Watt transmitter a few feet away. The first thing to do is to put the receiver in a shielded box. Solder up some pieces of one sided PC board, thin copper or brass sheet or purchase a tin plated steel box from companies like Sescom (SB series, call 1-800-634-3457 for catalogue). Power each module from its own battery.

Right at the antenna input a low pass filter, to pass everything below 7s Mhz but roll off 400 Mhz, can save your ship from becoming a mangled mess. Drill a hole in the shielded box and epoxy in place the .22 uH inductor half in and half out. Solder the 33 pF caps - one inside, one out- from the inductor to the box with very short leads. Solder the receiver board ground to the box near the antenna input as well as few other places directly or with short buss wire jumpers. Reconnect the R/C receiver wire antenna.

Before the next flight, place the craft far enough away to be just within it's minimum signal strength range for full control. Then turn on the ATV transmitter and see if you still have full control. If not, as a progress reference, move slowly closer and note the spot where full control is regained. Then go back to the bench and try adding at the DC power input, a 1000 pF feedthru cap through the box. Same to the servo or other leads if necessary. That should keep the leads from conducting the ATV RF inside the receiver. In addition try changing the positions of the two antennas or signal wires and separating the R/C leads from the ATV leads to prevent crosstalk. Go back out and see if the changes and additions improved control range.

The ATV transmitter should be shielded and the power and audio lines filtered in the same way as the R/C receiver. Use small RG174 coax for the video lead with no bypassing greater than 100 pF. The camera may also need shielding.

Most effective antenna for R/C aircraft is a vertical dipole embedded in the tall fin if > 13" high. Run 50 Ohm RG174 coax from the transmitter to the dipole feed point. Slide 7" of braid from some RG58 over the RG174 and solder to the 174 shield only at the point 7" down from the feed point. Then solder the 6.75" pieces of #12, one to the center and the other to the 174 shield. Check VSWR and trim each end 1/8" at a time for minimum.

R/C or Portable ATV DX

The antenna is the most important factor in effective radiated power rather than the transmitter power. You want an efficient antenna that has a radiation pattern maximum in the direction and polarity of the receive antenna. That is why we suggest the vertical dipole or 6.5" whip with a ground plane on the craft of Diamond RH77CA antenna with a ground plan for portable. A vertically polarized omni is the most practical antenna for most applications. To receive you can make a ground plane and use the Diamond NR-770H or the isopole antenna. The receive antenna must be above head height (6 to 10 ft) to maintain line of sight.

Line of sight distance can be predicted given power, antenna gain, coax loss, receiver noise figure and bandwidth. Non line of sight cannot due to the different attenuation's of the obstructions or reflections...you just have to try it to see what you get. One exception is temperature inversion skip which can duct even a 1 watt signal to be seen hundreds of miles away.

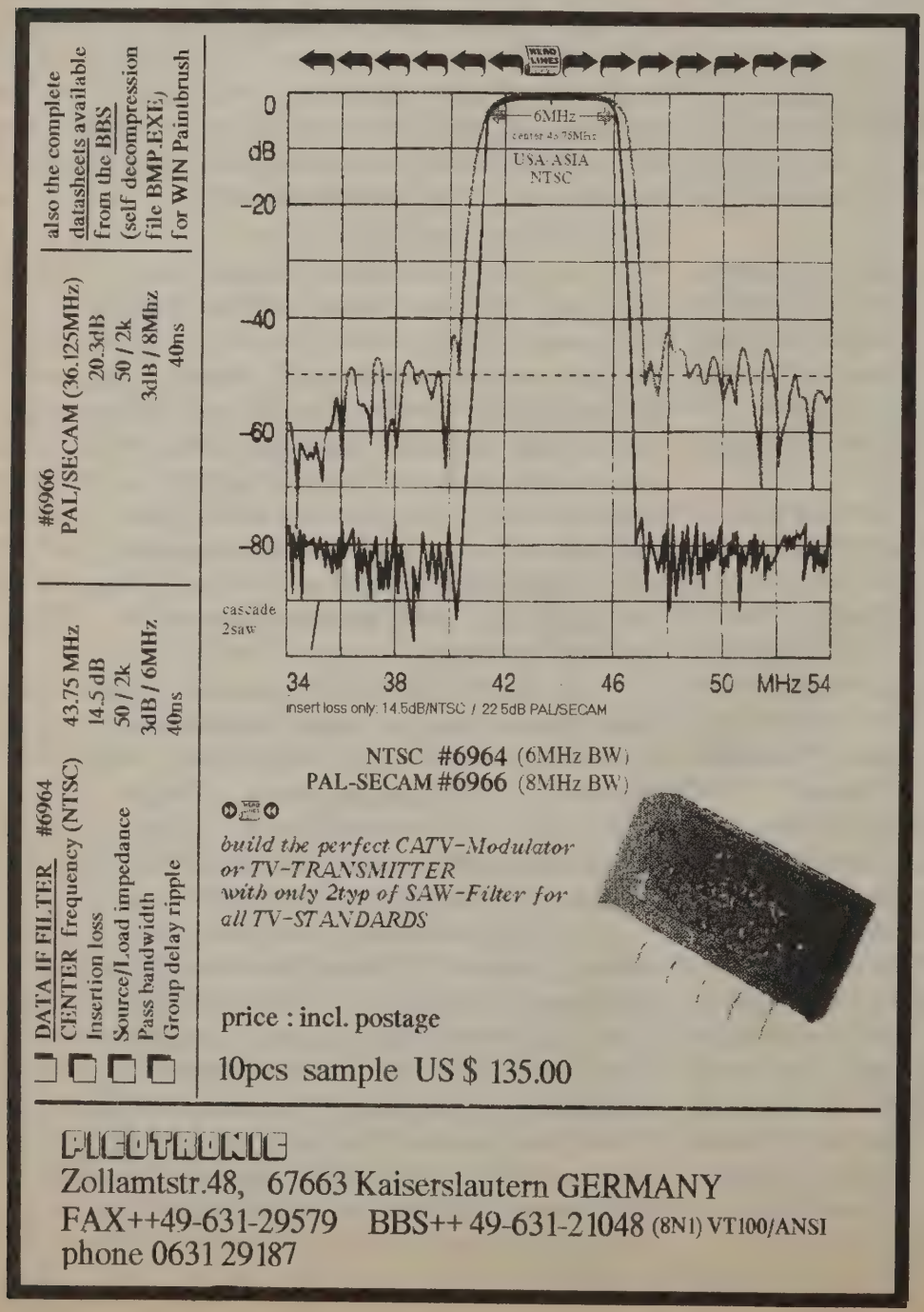
If you increase your radiated power or receiver antenna gain by 6 dB (4 times) you double the distance for the same picture. 3 dB (2 times) is 1.4 times the distance. Snow free P5 line of sight DX dipole to dipole or isopole, aligned in their maximum radiation lobe to each other for 100 milliwatts is about 1/4 mile and goes to 1 mile if a KLM 440-6X beam is used at the receive end. With 1.5 watts it is 1 mile and 4 miles respectively. Past these distances the P unit picture snow rating roughly decreases by one at each doubling of the distance. 100 milliwatts on an R/C could still

R/C Receiver Applications Note

key up and be seen with a lot of snow in a repeater 10 to 15 miles away. Local frequency selection and local 2 meter ATV coordination channel use is strongly recommended to minimize interference during operation. 426.25 Mhz is most used for R/C and simplex. 910.25 goes half the dx as 70cm.

ATV requires about 150 to 200 microvolts at the downconverter input for a snow free picture compared to 1 microvolt for good readable audio in a FM voice HT. This is due to the much wider bandwidth -3 Mhz vs 15 kHz - resulting in a 23 dB higher noise floor. That is why ATV requires a little more attention to minimizing and RF losses (coax, connectors, construction, etc.), antenna gain, polarity and directivity than you would get away with on FM voice.

73, Tom O'Hara, W6ORG



CHOPPER ATV

Greetings!

Has anyone any experience with mounting a camera in a full size helicopter (not a RC model)? I'm thinking about putting one of those Pcmount type cameras that Tom mentioned in the list a week or so ago and would like to hear about experiences on mounting.

Yesterday we tested a camcorder (Sony 8mm) and had some vibration problems. We didn't really have a good mount, just put it on the nose cone. What we would like to do is have it mounted at an angle so you are looking down at the ground when flying and not just at the horizon.

Doug Ferrell

(from ATVQ E-Mail net ATV@Tallahassee.net)

SUGGESTED OMNI ANTENNAS FOR RECEIVING ATV FROM ROCKETS & OTHER VEHICLES DIRECTLY OVERHEAD

A vertical omni has a pattern null directly off the end or straight up. A horizontal dipole is fine, but if the transmitting dipole is rotated 90 degrees from it, it also has a null. The answer is a horizontal omni with two dipoles at 90 degrees fed to the same coax. On the rocket you can then place an inverted V dipole on the outside of the rocket and not worry about the signal strength varying with the spin rate or position.

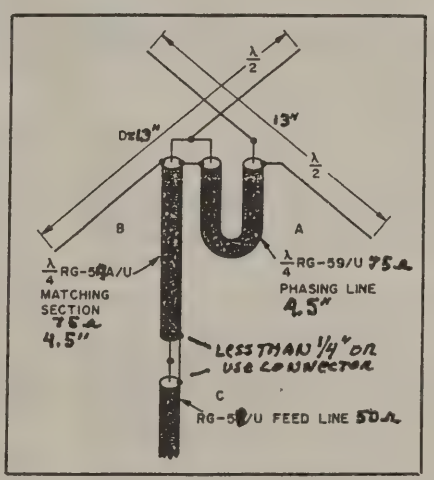
The 146 Mhz Turnstile is commonly used by homebrewers for satellite work and can be found in the ARRL Antenna Book 14th edition and Sept 74 QST. We have scaled and noted the dimensions for 426.25 Mhz. For those who want to buy a ready made antenna, we suggest the M2 "Eggbeater" with reflector. Circular polarized beams can also be used but with their narrower beam widths the antenna will have to rack the transmitter.

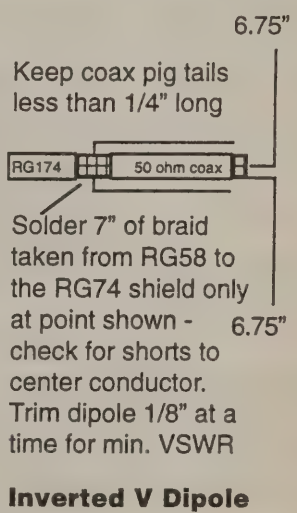
426.25 MHS Turnstile Antenna

The turnstile antenna is a simple, inexpensive and effective one for OSCAR satellites, balloons and rockets where rapid fading is a severe problem. The circular polarization lets the vehicle be a fixed polarization that is rotating or varying due to its natural motion with little reception affect. The turnstile is circularly polarized at high elevation angles and has a broad balloon-like high-angle directivity pattern.

Construction

The mast used to support the two dipoles is made of wood, being 2 inches square and 8 feet long. The dipoles may be made of no. 122 copper wire, brass rod or tubing up to 1/4" diameter. Mount the two 6.5" dipole pieces on one side of the mast and centered and 1/8" feed point spacing with 3/4" long #6 wood screws. The other dipole is 1/4" above the other on another side. The RG-59 coax pigrails should not be longer than 1/4" long. Carefully solder on the coax and phasing line then check for shorts. Run the coax and phasing line down the mast. The spacing from the screen to the dipole is 9.5". Two holes spaced 1" apart can be drilled for two 1/4-20 x 3.5" machine screws to hold the mast to the frame. Off set the frame cross piece so that the dipoles are roughly centered and snip a 2" square clearance hole for the mast and enough on one side to clear the coax and connector. Lash the coax to the mast with enough plastic cable ties that the coax cannot be pulled on and break the dipole solder connections. Drill the matching holes in the frame. For more portable use, the machine screws will allow removing the mast for transport. The mast can also be made in pieces. The reflecting screen is hardware cloth with a minimum of 1/2" mesh. It can be cut from a standard 18" or 24" roll to 16.5 inch wood. The frame and mast is made from 1x2 inch wood. Cut two pieces 17" long and three 15" long. The screen is stapled or fastened with double pointed tacks to the 1" side. Before putting on the screen, a few coats of spar varnish is suggested on the wood. Cover the coax and dipole solder connections with silicon rubber.




6.75"
Keep coax pig tails less than 1/4" long
RG174
50 ohm coax
Solder 7" of braid taken from RG58 to the RG74 shield only at point shown - check for shorts to center conductor. Trim dipole 1/8" at a time for min. VSWR
6.75"

Inverted V Dipole

This is a copy of a printed handout. Original diagram is available from PC Electronics.

R/C ATV TRUCK

I'd like to join the RC/ATV fun, and also send an ATV setup up on a kite. Are there any micro video cameras that run on 6 or 7.2 volts? I'm looking for specific brand recommendations and prices.

I've bought a few cameras from SuperCircuits, and they do the job ok. The small black and white ones need 8 to 13v, and the image does seem to fall apart at around 8v.

Because of the wide input voltage tolerance, I'm guessing there's a 5v regulator in there. If you bypass the regulator, you may be able to set up your own less tolerant power input that can run on lower voltage.

Also, what is current draw like? It's rated at 160mA, but mine seems closer to 100mA.

Check out http://www.scx.com for the catalogue and specs (1-800-335-9777). I've been pretty happy with the SuperCircuits stuff, but you have to watch their billing. They've overcharged me for two out of three items now, and it was a slow struggle to get the credit refund. Steve Haehnichen steve@vigra.com

later...

I've finished building my R/C ATV truck, using a modified Kyoso USA-1 4WD frame and a PC Electronics 1W transmitter.

All in all, it works great. I've got a tiny Supercircuits B&W camera on a servo-controlled gimble for tilt, and a small dipole antenna that seems to transmit nicely. I get about an hour of transmission, but only 10 minutes of drive battery.

Anyway, I'm using a small Radio Shack active-matrix portable television to receive the signal. Outside of sunlight, this works fine, since the TV tunes a little out-of-band and can receive it at just below regular UHF. In the sun, the screen is completely washed out.

I'd also like to record the video, so I'm looking for a tuner of some sort that can do something similar, and output baseband video. (I can then run the demodulated video into a camcorder for recording.)

The little TV is nice, but it's receiver is not real hot. I'm looking for something with a nice front-end, and tunable frequency that can hit 430 Mhz.

Has anyone tried gutting a VCR for a tuner? Did it work? Steve Haehnichen steve@vigra.com

$179 Color Camera

I put a short note on the KD4MOJ ATV internet re-emailer about seeing a camera ad in the February Nuts and Bolts, but did not order one myself; how many does one need WB6YSS would tell me, and you never did package up that board camera you got last year at about the same price.

Some of the guys on the local ATV repeater net got some and they looked quite good on the air; they have been giving me a bad time about the color from my old dying camcorder. The pressure on the net was too great, so I weakened and made the call. All I say is this deal should not be passed up!

The color, resolution and sensitivity is fantastic. These cameras were made to sit on top of a computer for teleconferencing. As such, it sits on a swivel and tilt base and even includes line level output mic audio. Surprisingly this is not a board level camera at this low $179 price, but packaged in a plastic case about 5x3x2 inches and ready to go.

The camera comes with a 12 Vdc 300 ma wall plug power supply but you can also run it off any dc power from 10 to 15 volts for portable or mobile. Current draw was 160 ma at 18.8 Vdc but went up to 180 ma at 10.0 Vdc.

The sensitivity and color brilliance is quite good even in a room with just one overhead fluorescent lamp. The automatic light control does a good job from room to outdoors but there is an iris control to increase the range on either end if need be.

The lens is fixed but seemed to hold good focus down to less than one foot. Horizontal field of view is about 72 degrees or 7.5 inch for every foot of depth from what I measured.

Sycard said that they had plenty in stock, so if you could use another good color camera - he who dies with the most cameras, etc. - to give another viewing angle of the shack, go mobile or portable, point at an ID card, or just cuz, I can recommend this one.

To get yours call Sycard Technology at 408-749-0130 or fax 408-749-1323. They take credit cards or call for a total to send a check. UPS surface was $5 on top of the $179 for the camera.

TOMSMB

RELIABILITY OF GAIN SPECIFICATIONS FOR ANTENNAS

from VHF Communications *Steen Gruby, OZ9ZI*

A few years ago, I bought myself a commercially manufactured amateur radio antenna made by a Japanese firm, which was designed for the frequency range between 1240 and 1300 Mhz. My experiences with this antenna and the reliability of the technical data listed for the antenna formed the basis for this article.

Introduction

Previous experience of antenna measurement - in Haslev in 1985, etc. - had already given me some idea of what should be expected when the gain specifications for an antenna are investigated in reality using a test rig.

There are many methods of measurement which refer back to the logarithmic Bell scale. The dBi unit stands, for example, for a gain measured with an isotropic source antenna as reference antenna. The dBd unit, by contrast, stands for the gain which is measured against a dipole as reference antenna.

The isotropic source antenna is a hypothetical isotropic source, which technically can not be manufactured, and so the specialist uses the dBd unit of measurement as the most honest unit. The metrological difference between an isotropic source and dipole amounts to 2.16dB in favor of the dipole, so 2.16dB units must be added to any gain specification in dBi units.

dBa is a unit of measurement which is used for acoustic measurements - i.e. sound measurements. The term "dBa" could also be used to stand for "dB (radio) amateurs," but that would be a very confused value. I could imagine introducing the units of measurement dBg, in German, and dBt / dBb, in Danish/English, with the following meanings:

dBg for "glauben" ("believe"),
dBt for "tro," and
dBd for "believe."

These descriptions would stand for what radio amateurs actually do when they uncritically accept the data for a commercially manufactured antenna. And how can you know what reference value was used to "measure" the antenna in question (assuming there was a measurement in the first place)?

The Myth

We radio amateurs are therefore compelled to place our trust in the technical data from the manufacturer, because we have no simple way of checking the. Hence the new term dBg, because most things involving antennas and antenna gain specification are a matter of belief or trust.

Manufacturers of antennas for professionals are also compelled to adhere to the limits specified for their products, since many of their customers are in a position to check them. It can therefore be assumed that the data provided by such firms correspond to the facts and that, as a rule, the antennas are also supplied with a radiation patter obtained using metrology.

Things are different for those manufacturers whose products are almost exclusively sold on the amateur radio market. Here we are given fantasy values as "free extras." To put it another way, there is no comparison between the antennas which are supplied to the professional market and those which people want to palm off onto us radio amateurs.

If suppliers of antennas for radio amateurs are actually in a position to measure the values shown in their advertisements, why then don't professional users buy antennas from them, instead of paying higher prices for apparently worse products? The explanation for this is that the actual technical data for antennas for radio amateurs do not correspond to the data in the adverts. When I say that, this does NOT mean that all antennas which are available on the amateur radio market are useless. I merely wish to point out that a healthy skepticism should be exercised here in relation to the values specified.

The Facts (or those available)

There are antennas for radio amateurs, the actual performance of which does correspond to the specified data. However, thee have a hard time competing with those for which the data are expressed in dBg units - the gain is just the most important characteristic laid down.

Another disadvantage with antennas for radio amateurs is that a radiation pattern is not normally provided. It is thus not possible to obtain an impression of whether the desired gain is actually where you need it. It is in fact very difficult to construct collinear antennas in such a way that the radiation pattern gives a maximum value in the horizontal plane - and the higher the desired gain, the more difficult it becomes.

VS-90 ATV Repeater Controller

4 Video Inputs. 4 Audio Inputs. Repeater, Manual & beacon modes.
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Completely DTMF programmed w/full set of control and user codes.
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Antenna Gain Specs...

To put it another way, if a wire which is several wavelengths long has power fed into it at one end, the radiation is directed to the other end of the wire. So a wrongly adjusted collinear antenna usually gives a radiation characteristic which is directed upwards, i.e. from the end of the antenna. But at the point where the gain should be located some attenuation is taking place, i.e. a negative gain, by comparison with a dipole.

This is precisely what I found was happening with the antenna which I had bought for the frequency range between 1240 and 1300 Mhz. This was a Maldol antenna, type HS-GP 1219, which was tested against other antennas in a measuring field.

I then wanted to carry out specific measurements on antennas manufactured for radio amateurs. I leave it to you, dear reader, to determine how useful these antennas are.

Antenna Measurements

In my opinion, the antennas selected for these measurements are those most frequently purchased. They are certainly those most frequently mentioned in our region. Here is a list of the models (from various manufacturers):

COMET CA-2x4 MAX, 2 bands, 144 & 432 Mhz, length 5.40m
COMET CA-2x4 Super II, 2 bands, 144 & 432 Mhz, length 2.43 m
COMET CX-902, 3 bands, 144, 432 & 1296 Mhz, length 3.07m
COMET CA-1221S, 1 band, 1296 Mhz, length 2.34m
DIAMOND X-6000 W, 3 bands, 144, 432 & 1296 Mhz, length 3.05m
DIAMOND X-300, 2 bands, 144 & 432 Mhz, length 2.09m
MALDOL HS-GP 1219, 1 band, 1200 Mhz, length 1.99m

4.1 *Measuring Field*

The measuring field in which the measurements were carried out belongs to Danish Telecom, and is a

licensed measurement field which is regularly inspected. The measurements were carried out by Danish Telecom employees, who are completely familiar with the use of the measuring field and the associated measuring systems. Thus any doubts about the serious nature of the measurements below can be excluded in advance.

Measurements were carried out for all the antennas at the frequencies referred to in the frequency plan for IARU Region 1: in the 2m band at 144, 145 and 146 Mhz, in the 70cm band at 432, 434, 436 and 438 Mhz, and in the 23cm band at 1296, 1297 and 1298 Mhz, where predominantly vertically polarized communications traffic takes place.

The performance of the Maldol antenna was also measured over an extensive band width up to 1195 Mhz, in an attempt to find an explanation for its radiation characteristic. This was repeated with the Comet CA-1221 S, as this is also a single-band antenna for 1296 Mhz, which is supposed to cover the entire band width.

The antenna gain was measured vertically to the antenna or in the horizontal plane. This kind of measurement gives a worse result for antennas for which the main radiation is not situated in the horizontal plane. To summarize the measurements, an average antenna gain was calculated for the band in question, which applied to the entire band width, as the manufacturers do not state where the specified gain was measured. This value was deducted from the antenna gain specified by the manufacturer, which gave the difference between the values shown in the advertisements and the actual performance of the antennas. In relation to the radiation characteristic, it should be pointed out that "the bottom" (the distributing point of the antennas) is at the 90-degree point for all measurements. That means that an upward radiation due to structural errors, which is characteristic of some antennas, is a radiation in the direction of the 270-degree point.

Test Results

The Maldol antenna registered an upward radiation mounting to 10 to 20 degrees, which varied over the bandwidth, at all frequencies in the range between 1240 and 1298 Mhz. For antennas with a high gain, the beam angle was so small that there was a dead zone in which no signal was available. As regards the Maldol antenna, there was a very specific attenuation effect here - more than 10dB, as against a dipole. The antenna gain was specified as 12.2dBi. The antenna was thus one of two antennas measured, the gain of which was specified with reference to an isotropic source. So that it could be compared with the other antennas, then, 2.16dB had to be deducted, which still left a gain of 10.04dBd. Naturally, at 1.296 Mhz the antenna displayed a gain of approximately 6.5dBd, though of course at an angle which was no fun for anyone, since the signal was radiated heavenwards. (See also Fig. 4, bottom right.) A measurement at 1195 Mhz gave a gain of 9.9dBd and a radiation characteristic in the correct position. If the antennas had been intended for use at 1,200 Mhz, they would have had precisely the right technical data.

Specified values for the Comet CA-2x4 Max twin-band non-directional antenna were 8.5dBd, for 144 Mhz - and 11.5dBd, for 432 Mhz. The radiation pattern (Fig. 1) shed an upward radiation of 7 to 8 degrees at 144 Mhz, rising to 12 - 13 degrees at 146 Mhz. As can be seen from the table, the gain measured varied somewhat over the entire bandwidth. The average gain was 4.3dBd, i.e. 4.2dB below the manufacturer's specifications. AT 70cm, the radiation characteristic was acceptable over the entire bandwidth.

The gain between 432 and 436 Mhz was 6.5dBd. At 438 Mhz, the gain fell back to 5dBd. The average gain amounted to 6.25dBd, i.e. 5.15dB below the manufacturer's specifications.

The specified values for the Comet CA-2x4 Super II were 6.0dBd at 144 Mhz and 8.4dBd at 432 Mhz. The radiation patterns for both bands were acceptable, with a negligible downward radiation at 432 Mhz (Fig. 1). The measured gain varied between 3.6 dBd at 144 Mhz and 2.3dBd at 146 Mhz. The average gain was 3.1dBd, i.e. 2.9dBd too low. As can be seen from the table, the gain measured at 70cm oscillated between 4.7dBd and 3.2dBd over the entire bandwidth. There was an average gain of 4.2dBd, i.e. exactly half the value specified by the manufacturer.

The values registered for the Comet CX-902 should b 6.5dBd at 144 Mhz, 9.0dBd at 432 Mhz and 9.0dBd at 1296 Mhz. The radiatoin characteristic looked good at 2m. Radiation directed a few degrees downwards at 70cm could be detected. This was also acceptable. At 23cm, the radiation characteristic looked very bad. It could be described as diffuse (Fig. 2). The measured gain at 2m was 3.0dBd at 145 Mhz. At 144 Mhz and 146 Mhz, it was

continued on page 40...>

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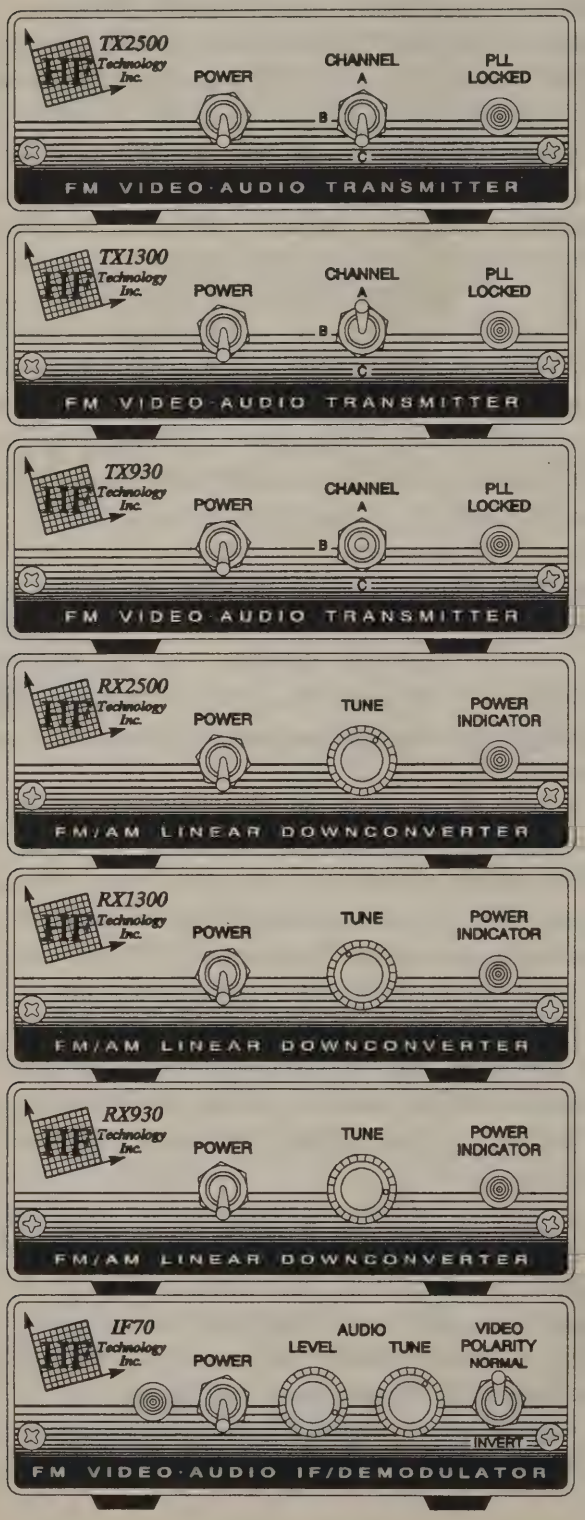

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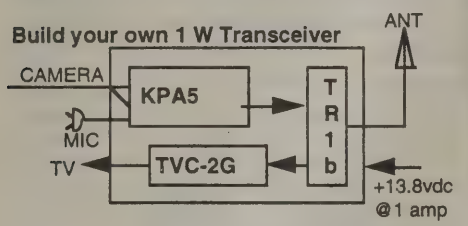

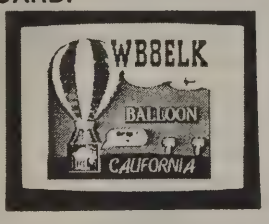

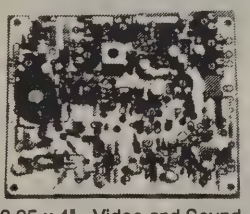

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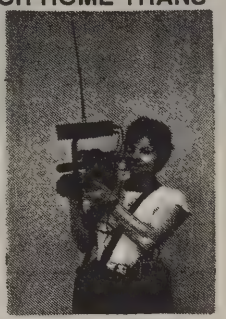

KPA5-F 70CM ATV XMTR BOARD FEATURES:

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TVC-4G..$89 or TVC-2G..$49 Downconverter (page 5)
RG174 50 Ohm 1/10 inch dia. coax cable, 6ft.....**$3**
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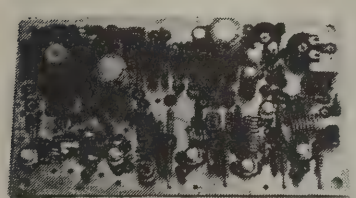

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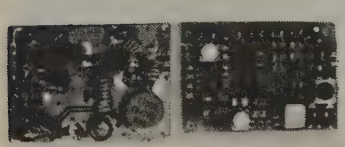

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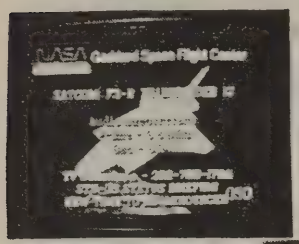

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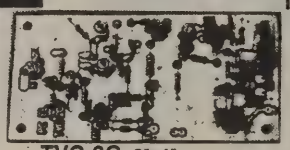

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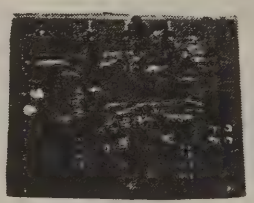
TVCX-4



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TVCX-70 XTAL CONTROLLED GaAsFET DOWNCONV...$109 Crystal controlled version of tuneable TVC-2G board used in repeaters or unattended operation with wide temperature variations or at a public service event where a tuning knob might be touched by unauthorized persons. Specify input frequency (421 to 440 MHz) and output (ch 3 45 or 70 MHz IF). Req. +11 to 15 Vdc @ 50 mA, shielded enclosure N input & F out connectors. 2 freq. add..**$20.** LMB CAB-234 box...**$14**

TVCX-4 is the TVCX-70 board ready to go in the CAB-234 box .....**$139** Type N ant. input, F TV out. Two frequency with toggle switch installed....**$169**

WE ALSO STOCK THE MIRAGE KP2-440, DOWNEAST 900 & 1200 MHz ANTENNA MOUNTED PREAMPS, HIGH FREQUENCY TECHNOLOGY TX1300 FM ATV TRANSMITTER & IF70 FM RECEIVER.

BUILDING AN ATV REPEATER?

Ask for our 8 page ATV repeater application note with info and sources for all the components, site and construction hints. Read this app note before you spend your first buck and do it right the first time.

ATVR-4 ATV Receiver crystal controlled in a die cast aluminum box. Two composite video outputs, line and speaker audio outputs. Req. 13.8 Vdc @ 300 ma. Specify input frequency - 439.25, 434.0, 426.25 MHz most common.....**$319**
ATVR-9 for 910.25 or 923.25 MHz...**$329** **ATVR-12** for 1241.25, 1253.25 or 1277.25 MHz...**$349**

RTX-70 1.5 Watt ATV repeater transmitter in die cast box - drives D100ATV-R 90 Watt amp. 421.25 or specify.....**$279**

KLM and RUTLAND BROADBAND BEAMS FOR ATV

Isopole

KLM 440-6X 8.9 dBd gain, 28" boom, vertical or horizontal polarization rear mount. Ideal for point to point, fixed at a repeater or small enough to be portable at public service events to minimize multipath ghosts and get some gain at the same time. Wide 60 degree beam width. All 6 include 50 Ohm balun with Type N female conn.....**$65 delivered UPS surface**

KLM 440-10X 11.2 dBd gain, 64" boom, rear mounting H or V. Bigger version of 6X.....**$82del**

KLM 440-16X 14.2 dBd gain, 10.5 ft boom, ctr. mtg. full 420-450 MHz BW, rugged.....**$142 del**

RUTLAND FO22-ATV highest broad bandwidth15.8 dBd gain,14 ft, ctr. mtg.....**$139 del**

The antenna, coax and tower height are the most important part of your ATV system and deserves your most care and attention. ATV antennas must have broad bandwidth in addition to high gain and low VSWR. Few other antennas work well at both 439 and 421 MHz. The three KLM and one Rutland antennas listed here fit the requirement and have a long history of rugged operation with ATVers. The gains listed have been proven out at VHF/UHF conference antenna measuring contests, they are not marketing hype. All four beam antennas listed here take up to the maximum legal power limit. Balun or matching network with female type N connector is included. We suggest using Belden 9913 (2.6 dB/100') or better 50 Ohm low loss coax or hard line. Belden 8214 (4.2 dB/100') is more flexible and is fine for runs less than 50 feet. Always verify any new antenna system with a RF power meter for less than 10% reflected power before normal transmitting over 20 seconds. Weather-proof all outside connectors.

AEA 450 ISOPOLE OMNI 3-4 dBd GAIN ANTENNA. 3.5 ft long, 50 ohm type N,1.25" mast mount.....**$89** Adjustable from 420 to 512 MHz. Great for portable/ base or R/C applications

DIAMOND F718 9.3 dBd OMNI 15' long, F718L=420-430, F718J=430-440 & F718A=440-450 MHz.....**$238** Great for repeaters, emergency operations centers or home station round tables without having to rotate a beam.

Remember when comparing prices, ours include UPS surface shipping in cont. USA. 5/96

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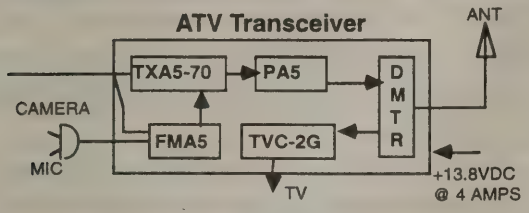
ELECTRONICS

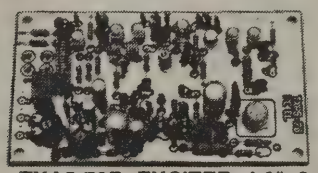
BUILD YOUR OWN 70 cm 10 Watt ATV STATION

Basic 10 Watt system - 3 Transmitting modules as seen in the ARRL Handbook



420-450 MHz BAND

See chapters 20 & 7 in the 85 to 94*ARRL Handbook* or chapter 12 in 1995-6. These modules are the latest upgraded generations. Mount the boards & parts for a 10 to 15 Watt basic module ATV transceiver in a 3x8x12" aluminum chassis for shielding and heat sinking, or Hammond 1590F die cast aluminum box like we did for the TC70-10. Use the DMTR-70-10 module to switch your 50Ω 70cm antenna between PA5 amp and TVC-2G downconverter. Schematic & layout comes with each wired and tested board.



TXA5-70B EXCITER 4.0"x2.25"

TXA5-70b ATV EXCITER/MODULATOR BOARD.....$89
Replaces TXA5-5. Smaller board for stand alone portable or R/C applications in addition to 10 Watt systems. Wired and tested board. Adjustable 50-80 mW output to properly drive the PA5 10 Watt module and in turn the 100W 4-110 or D1010N-ATV. Built-in sync stretcher. Accepts standard 1 volt composite video from color camera, VCR, computer, etc. Wideband modulator gives excellent color and high resolution. Draws 70 mA at 13.8 Vdc. One crystal included, but relay switch between 2 sockets. **Extra crystals $20.**
We stock 439.25, 434.0, 427.25 & 426.25 MHz, other 70 cm freq. may take 4 weeks to special order xtal. 100 Ohm carbon panel pot for video gain **$5.**

PA5 AMP 3.5"x2.0"

PA5 10 WATT P.E.P. ATV POWER MODULE.....$99
An all mode Toshiba S-AU4 is mounted on a heatsink with a stripline PC board to output over 10 Watts p.e.p. when driven by 80 mW from the TXA5-70. 50 Ohms in & out. Broadband, 420-450 MHz, linear, no tuning. 250 mW max RF input, do not use with 1 Watt modules. req. 13.8Vdc reg. @ 3 amps.

FMA5-F SOUND 3"x1.5"

FMA5-F AUDIO SUBCARRIER GENERATOR BOARD.....$39
Temperature stablized VCO with adjustable deviation to more than 25 kHz. Transmits broadcast standard sound with your picture. Accepts a Low Z mic (100-600 Ohms), also line level audio from VCRs, camera mics, computers, etc. Up to 1 v pk-pk drive to the TXA5-70, TXA5-RC or TXA5-33 exciter modulators. Works with any transmitter having 5 MHz modulation bandwidth. Req. 11 to 14 Vdc @ 20ma. We can special set freq. for FM or PAL up to 6.8 MHz.

DMTR-70-10 2.2x2.2"

T/R RELAYs TR-1b 2 x 1.8"

DMTR-70-10 T/R RELAY, DETECTOR & MONITOR BOARD.....$45
T/R switching for up to 15 Watt 70cm ATV systems. Negligible insertion loss, 60dB isolation. Mounts on flange type UG58 N chassis jack (**$2**). Relays for switching + power to all basic modules, camera video in rec. to detected output video in xmit. to monitor. 2.2x2.2". 13.8Vdc @ 120 ma.

TR-1b 70cm T/R RELAY BOARD.....$29
Simple 15W T/R relay and up to 1A +13.8 power relay. Mounts on UG58

4-110 RF CONCEPTS 100 WATT P.E.P. AMPLIFIER.....$359
420-450 MHz all mode: FM, SSB,CW, & ATV. Good color and sound from the 10 Watt basic modules or TC70-10. Sync power (p.e.p.) 100 Watts with blanking set for 60 Watts (6-7 Watt sync, 2-3 Watt blanking set up). ATV duty cycle 10 min on /5 off, other modes 5 on/5 off. RF sense T/R switching. 12x3x5.5". Req. 13.8 Vdc @ 22A. 15 Watts max drive. Receive Preamp.

RFC 4-110 100W AMPs

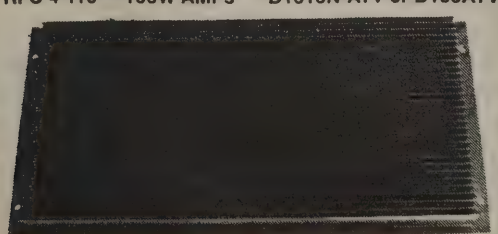
D1010N-ATV or D100ATVN

MIRAGE D1010N-ATV similar TX specs as 4-110, req 13.8 Vdc @20A.....**$369**

D1010ATV-R MIRAGE 70CM REPEATER AMPLIFIER.....$589
Continuous duty version of D1010N. Made to match TXA5-70/PA5 10 Watt modules. Rugged large heat sink for repeater or long key down time. 100 Watts p.e.p. or 80 Watts CW. 8.75" H 19" rack panel. T/R switch add $35.

D100ATV-R repeater version gets 90 Watts p.e.p. for 1.5 Watts drive from RTX-70 repeater transmitter (pg 6) or KPA5. 7 Watts drive maximum.....**$589**

D100ATVN MIRAGE 1.5 in/>70 WATT OUT AMPLIFIER.....$369
Designed to match our TX70-1b, TC70-1d, TXA5-RC and KPA5 1.5 Watt transmitters. 7 Watt maximum drive, cannot be used with the 10 Watt modules. All other specs the same as the D1010N.



D1010ATV-R or D100ATV-R

Remember when comparing prices, ours include UPS surface shipping in cont. USA. **4/96**

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1.4dBd. The average gain was 1.9dBd, i.e. 4.6dB below the specified value. The measured gain at 70cm amounted to 4.2dBd at 432 Mhz, 4.4dBd at 434 Mhz, 3.9dBd at 436 Mhz, and to only 2.1dBd at 438Mhz. There was an average gain of 3.65dBd, i.e. 5.35dB to low. Due to the poor radiation pattern, the measured gain at 23cm was 1.5dBd at 1296 Mhz, and down to only 0.9dBd at 1298 Mhz. The average gain was 1.23dBd, i.e. 7.7 dB less than the value promised by the manufacturer.

The Comet CA-1221S should have a gain of 14.8 dBi at 1,296 Mhz. Since the gain for this antenna is specified in dBi, just as for the Maldol antenna, once again we have to deduct 2.16dB, leaving 12.6dBd. Since this is a single band antenna, measurements were carried out over a larger bandwidth. At 1298 Mhz, there was an upward radiation of a few degrees (Fig. 2), at 1290 Mhz the radiation direction was satisfactory, and at 1260 Mhz there was a slight downward radiation. The maximum antenna gain was 8.1dBd at 1290 Mhz. It fell to 6.7dBd at 1298 Mhz and 5.8dBd at 1298 Mhz. The gain over the entire bandwidth was 7.1dBd, i.e. 5.5dB below the value specified by the manufacturer -5.9dB below in the upper range.

The Diamond X-60000W should display a gain of 6.5dBd at 2m, 9.0dBd at 70cm, and 10dBd at 23cm. At 2m, the radiation characteristic displayed a slight upward radiation of between 3 and 4 degrees. At 70cm, it was good for the range between 434 and 436 Mhz, and had rather a lot of large side lobes at 432 and 438 Mhz. The radiation pattern for 1296 Mhz was a study in side lobes (Fig. 3), in which the gain which the antennas are specified as having had apparently disappeared. The major lobe was about where it should have been, but the biggest side lobes were 4dB, 5dB or 6dB lower. The gain measurement gave a 3.6dBd at 144 Mhz, 3.3dBd at 145 Mhz and 2.0dBd at 146 Mhz. The average value was 3.0dBd, i.e. 3.5dB too low. Values for the 70cm band were 5.0dBd at 432 Mhz, 5.6dBd at 434 Mhz 5.2dBd at 436 Mhz and 4.1dBd at 438 Mhz. The average value was 5.0dBd, i.e. 4.0dB lower than specified in the data sheet. The 23cm band gave results as follows: 4.6dBd at 1296 Mhz 4.1dBd at 1297 Mhz and 4.5dBd at 1298 Mhz. The average value registered was 4.4dBd, i.e. 5.6dB too low.

The Diamond X-300 should display 6.5dBd at 2m, and should have a gain of 9.0dBd at 432 Mhz. A weak upward radiation was detected in the 2m band, with a weak downward radiation in the 70cm range, but both were insignificant (Fig. 4). The measured gain in the 144 mHz band looked like this: 4.1dBd at 144 Mhz, 3.7dBd at 145 Mhz, and 2.5dBd at 146 Mhz, giving an average value of 3.4dBd, which was thus 3.1dB below the promised gain. The picture in the 432mHz band was: 6.6dB at 432 Mhz, and 5.3dBd at 438 Mhz, giving an average value of 6.25dBd which was "only" 2.75dB from the value the manufacturer wishes to talk us into accepting. Of the antennas tested here, the values measured for these antennas were, coincidentally, closest to the specified values.

Well, 2.75dB isn't such a large deviation...or is it? Well, unfortunately, antenna gain specifications involve a logarithmic unit of measurement. So an alteration of 3dB means the value is halved or doubled. So the antennas for which the specifications were checked were not even half as good as the manufacturers made them out to be. If you bought a car with a specified maximum speed of 200 km/h, and then you found out the maximum speed was 100km/h, you'd certainly complain about it immediately! What we're talking about here is of the same order of magnitude!

Summary of Test Results

The average values for the Comet are 3.9dB lower than the specified values for the antenna in the 2m band, 3.9dB lower in the 70cm band, and as much as 6.9dB lower in the 23cm band. The Diamond values registered are 3.0dB lower than the specifications for 144 Mhz, 3.4dB lower for 432 Mhz and 5.6dB lower for 1296 Mhz. See also summary in Table 1!

If we summarize the values specified by the two manufacturers, we obtain the following average deviations:

3.45dB at 144 Mhz
4.15dB at 432 Mhz
6.25dB at 1296 Mhz

Earlier in this article, I introduced the terms dBg dBt and dBd. I might now also consider introducing the unit dBj, where j stands for Japan. In accordance with this, the dBj values (as per the above table) would have to be copied form the specifications for Japanese antennas, to obtain a value which MAY be correct.

Conclusion

I am well aware that this article may trigger intense discussion, but the figures speak for themselves. In writing this article, I have tried to ensure that my fellow radio amateurs adopt a critical attitude to specifications and insist on receiving reliable information from manufacturers. At the same time, I was also calling on the manufacturers to provide data based on actual documented measurements regarding their product.

HATS

All Members and Interested ATVers

As those of you on the HATS e-mail list know, we have been asked to write an article about HATS and FM ATV for QST magazine. I have been working on this for a few days now. Please come to the meeting on Wednesday and put in your two cents worth. (i.e., be sure your name is mentioned.)

Bill Potter, N5MBM, and Pick Pense, WD5BQN, among others have put in a lot of work setting up equipment and antennas at the new Emergency Operations Center, near 610 and I10-West. This site now is receiving the HATS repeater on 421.25 Mhz and can uplink to the repeater on a dedicated 1.2 Ghz AM link. This will allow us to provide video coverage to them during any kind of emergency. They also have the ability to place this video on a large rear projection TV screen in a room that reminds me of NASA Mission control. Oh, by the way, I found out that this is where all those TV cameras on the freeways feed to. The controllers can tilt and pan the cameras at will to better see traffic flows, accidents, etc. The HAM operating positions at this facility are equipped with multiple HF, VHF, UHF, and now ATV radios. If you get the chance check it out!

We now have about 6 takers on the 1.2 Ghz FM 1 Watt ATV kits here in Houston. We are looking for four more so we can sell the first 10 units locally. We have already allocated club funds for this project, so let's make sure this is a success. I have received two requests for information on the kits from outside Houston. I have set up a list-server of all interested persons. This will allow me to send them info as it becomes available. I have the list set up so only the administrator can post to the list, so don't even try to send to it. Just drop me a note at N5JXO@stevens.com if you want to be put on the list. If we want to, I can set up a list-server of all who purchase kits like a users group. It may be fun to see how others use the kits or it may be an e-mail headache. Let me know what you think.

Be aware that the weekly ATV meeting is every Wednesday at 9:00 pm. Last week users were showing up a little late. But it was great. If I can get the check-in sheet, I will list the active participants here! Some of those uplinks were P5! Also, during the AMSAT net on Sundays at 10:00, Andy MacAllister, WA5ZIB, sends us some excellent video and balloon tapes to keep us awake. Also excellent video.

Gang. The Tenneco Marathon was a great success for ATV. Every comment that I have heard has been positive and enthusiastic. I welcome any additional comments, whether positive or otherwise. Now is the time to debrief ourselves before we begin to forget.

A great big THANK YOU to all who participated in this year's Houston Tenneco Marathon.

Carl Kotila, WD5JRD; Jeff Johnson, KC5AWJ; Malinda Johnson; Tony Summerville, N5RPQ (who got sick and had to drop out at 6 am!); Charlie Keng, N5XWT; Ray Blackstone, KC5LCP; Scott Byrd, N5KEU; Fred Juch, N5JXO; Andy MacAllister, WA5ZIB; Mike Scarcella, WA5TWT; John Ross, WA5WOD; Stewart Ross; Bill Potter, N5MBM; Steve Leeson, N5ENC; John Allen, KC5OYV; Jan Potter, N5VGE; Clem Winford, WB5SH; Rick Pense, WD5BQN; John Allen, KC5JRS; Fred Ware; and Ed Manuel, N5EM.

The results were exceptional. The repeater worked flawlessly. The new "charlie" version of the KC5AWJ 1.2 ghz transmitter board worked perfectly for the entire marathon putting in P5, no snow, full color pictures into the George R. Brown Convention Center from their station at Main and Lamar.

Again, let me emphasize how impressed the folks in the VIP area of the GRB are to see the live coverage on a continuous basis. It was always interesting to see them flock to the big screen TV when Channel 2 cut to the live marathon coverage. Then, 10 or 15 minutes later when they cut back to their regular programming, the crowd would move back to our table where the coverage never stopped. Several race officials came up and told us how much they appreciated being able to see the race, rather than the start and the finish and nothing in the middle.

During the race, we had six (6) camera teams setup along the course. That corresponded to 7 mile locations, since Jeff and Charlie"s team at Main and Lamar covers mile 5 at the start of the race and becomes mile 25 at the end of the race. Even with 25 miles and nearly that many water stops, the 6 teams provided excellent coverage of the entire race. For those not involved, this year all coverage was done with 1.2 ghz equipment. Some teams had 70 cm receive and reported excellent video. At the GRB, we had two 1.2 ghz stations; one on the team at Main and Lamar full time direct and one on the repeater. This cured virtually all the problems experienced in previous years trying to use 70 cm AM television as an uplink.

Already we have some new ideas from this years race. Dick Wilke really wanted to have ATV reception inside the trolley that runs ahead of the lead runner. We did not feel that this was particularly doable this year but I hope that next year someone will take the challenge of trying this.

We have realized that the current camera teams have real problems with cameras tied to cables (that are always too short). We are beginning to discuss how we might convert this to Rabbit based wireless system, like the one Fred demonstrated at the ham convention in Humble back in November. That would give the camera operator complete freedom to shoot from various angles and pay more attention to composition and camera work.

The marathon folks would like video tape of our coverage next year. They use local video shot by some of their volunteers to check that lead/seeded runners actually make it through all the check points. This is to ensure the integrity of the event. Video from our coverage would provide an additional means of confirming this. I discussed this with a race official and they suggested they would provide the VCRs. I suggested that they might also get someone to donate a couple of big screen TV's for the GRB to make viewing better and they though that this could be done (we used a 19" TV from Bill Potter and two old Commodore video monitors).

So that's my wrap-up. Please drop me your ideas and thoughts while they are still fresh. We need to talk at the next HATS meeting about the up-coming March of Dimes Walk America. That's about 3 months off. We didn't feel prepared to provide coverage last year but this year we are hot from a successful marathon and we need to decide if this is for us. See you on the repeater and at the next meeting.

73, Ed Manuel, N5EM
Tenneco Marathon Coordinator

HAGERSTOWN, MD

In South Central PA, Hagerstown, MD and NE WVA area, we have a new ATV club. We were officially formed on March 14, 1996. The group's name is Valley Amateur TV Society." There are approximately 8-10 charter members. We hold meetings the second Thursday evening in Hagerstown, MD every month. The club officers are:

WA3PTV, Joe - President
K3UMV, Bill - Vice President
N3VGS, Tim - Secretary/Treasurer

May 5th at the Hagerstown Radio Association sponsored Hamfest, we plan an ATV demo and seminar. I've built and have on the air an ATV repeater (testing) at my QTH approximately four miles south of Mercersburg, PA on 421.25 out and 434.000 in. We have an ATV net every Wednesday evening between 7:30 pm and approximately 9:30 pm. I'm a member of the CAATV group.
Joe Lockbaum, WA3PTV

OMAHA, NE

Installed a new video link on 1250 Mhz. 20 output, 6 subcarriers, 5 of which will link repeaters and packet.

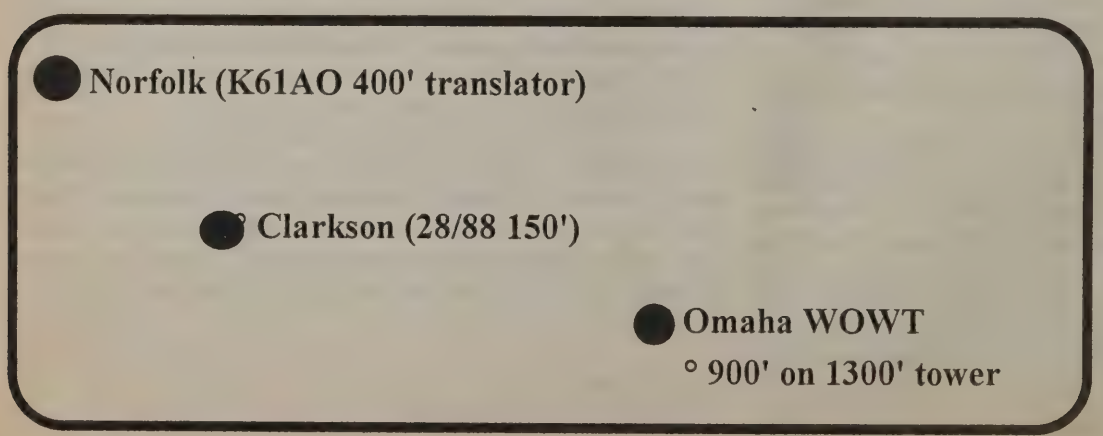
Path is 100 mi and 60 mi with about 5° different azmuth. It will soon tie two 434/421.25 systems together, Omaha-Clarkson (60 mi) and eventually Omaha - Norfolk (100mi).

ATV RPT FOR SALE

My name is Chad Johnson, W3IKO, and I am the President of the Sky High Amateur Radio Club, Incorporated of Citrus County, Florida. Our club put together an ATV repeater system in 1993/1994. We are a club of a little over 200 members and since putting the ATV repeater on the air, participation has shrunk to only two members who have ATV capability. This month the club voted unanimously to sell the system. As you will note, the system is not quite complete. A club member loaned the club some of the necessary equipment. However, most of the system is listed here for sale. We are asking $1,800, or best reasonable offer. I do not know anything about ATV. The system was put together before I retired to Florida. Your comments on the offering would be appreciated. I also do not know your advertising rates. Please let me know what the cost will be. You were referred to me by Chuck Brinegar, WA4PEQ, one of the two members with ATV equipment, as a place to start in my quest to sell this equipment. I thank you for your time and consideration.

73, Chad, W3IKO

List of ATV equipment for sale:
Diamond antenna (420 Mhz) F718L
Diamond antenna (430 Mhz) F718J
Cushcraft Ringo Ranger (440 Mhz)
PC Electronics ATV receiver (ATVR-4)
PC Electronics ATV transmitter (RTX-70-1)
Mirage ATV repeater amplifier (D100-ATVRN)
Electronics video ID board (VDG-1)
Two International crystal vestigial sideband filters (FL407)
Micro Computer Concepts repeater controller (VS-100)



WEATHER SATELLITE SYSTEMS

from

Spectrum International, Inc.

PROsat II Display Sub System:	
Decoder Board and Software, Model TS-VGA SAT 4	$249.00
137 MHz Receiving Sub System:	
Antenna, Model CY-137-2	$109.00
Low Noise Pre-amplifier, Model TS 137-P.Amp.	65.00
137 Scanning Receiver, Model TS 137-Rcvr.	299.00
Orbit Predicition Programme, Model TS Track II.	99.00
Low Loss Coaxial Cable 65' with connectors fitted	65.00
	$637.00
1691 MHz Receiving Sub-System:	
Loop Yagi Antenna, Model 1691 LY"N"	$109.00
Low Noise GaAs FET Pre-Amplifier, Model TS 1691 HEMT	250.00
1691 Receiver, Model TS 1691 RCVR	350.00
Low Loss Coaxial Cable 65' with connectors fitted	65.00
	$774.00

The cost of a complete 137 MHz System is $886.00 ($249 + $637)
The cost of a complete 1691 MHz System is $1023.00 ($249 + $774)
The cost of the two Systems together is $1,660.00.

Demonstration Disc (IBM-PC VGA Compatible) of Signals recorded from wx-sat System are available for $3.
Shipping: FOB Concord, MA.
Prices subject to change without notice.

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VISA

CHICAGO ATV

Activity has been on the increase in the four state area (MI, WI, IN, IL) since the upgrade of the Peacock ATV Repeater. Located downtown Chicago, the system is housed in a cabinet with a co-located 147, 222, 444 and 1296 FM mode repeater and shares a common antenna site with the FM repeaters and numerous broadcast and 2-way systems. Operating on 439.25 input (lower vestigial sideband) with two in-line VSB filters and a TX-RX duplexer, and 421.25 MHz output, with two VSB filters and the TX-RX duplexer it survives the RF jungle of the most intense RF site in the world. The system uses a PC Electrnics exciter and receiver, an Elktronics ID board and a Mirage D100ATV amplifier. With all the filters, it manages only 22 watts output PEP. Four antennas are in place, one for each direction, but phasing has been a problem because the antennas are physically apart in a rectangle 75 feet by 150 feet. Up to 170 feet of coax is needed to reach each antenna from the equipment rack.

So far the system has been working fine with just the NW and SW antennas and a 2 way power splitter. This results in about 6 watts at each antenna. But it is still P5 up to 30 miles away, and stations up to 80 miles make it into/see the system. Despite the less than optimum antenna situation, the coverage is still remarkably circular, with only the east direction suffering. Michigan stations report P2-P3 reception and have difficulty accessing. With no antenna in that direction the signal must be bouncing off other buildings to get there.

Activity has increased and even the Thursday night N9AB ATV net is now using it for check-ins. Local audio intercom frequency is 144.34. Plans include an audio interface from the 70 cm FM voice repeater. The user control functions will be available also on the 70 cm voice channel. Currently a 4.5 MHz subcarrier audio on the receive signal will be retransmitted on a 4.5 MHz subcarrier of the transmitter. Remember to use LOWER sideband as 443.750 is a local FM repeater channel, not the ATV audio channel for the repeater.

The SE and E antennas will be activated later when time permits experimentation with phasing. A 33 cm and 23 cm receiver are planned for the future. The system is open for use at all times and requires a video signal (sync) to operate. There is currently no beacon mode.

RF POWER MEASUREMENT

Cheap and Easy Calibration

Fred Baumgartner

How long has it been since you calibrated your transmitter's power...really? The traditional method of measuring power involves reading the temperature increase of water, at a known flow rate, passing it through a dummy load and seeing only the visual (or aural measurements) while transmitting black. It is a messy, complicated, error-prone and time-consuming process.

Cooling Off

The dummy load - or station load - that spends its life permitting maintenance of a main and an auxiliary transmitter is almost always attached to some leg of an existing water cooling system. This is great for dumping power, but not so great for measuring it.

Many transmitter plants run a glycol mixture through their dummy loads in normal operation. While this keeps the cooling system from freezing, the varieties of glycol and the difficulties in keeping a precise water-glycol mix make determining the correction factor for the cooling liquid questionable.

Maybe worse, most cooling systems use a venturi-style dial flow gauge. Anyone who has ever watched these gauges bounce around knows the difficulty of reading the meter, least of all doing it accurately. If a glycol solution is used, we have yet another complication. Most flow gauges depend on the density of the fluid to operate. Glycol changes the density - yet another questionable correction factor to accommodate. Of course, a five-gallon bucket and a stopwatch can permit a fair calibration.

Finally, dummy loads work best with fairly high flow rates. The high flow means that the temperature difference between the water entering and leaving the load will only be a few degrees - or tenths of a degree - apart. As the temperature differential (the all important "delta-T") is the indicator of power, a small difference (resolution) decreases accuracy.

Given all of this, I doubt that many power calibrations come within 10 percent, and I'm sure a couple I've run across missed by 30 percent. Hard to call that a calibration. There has to be a better way than attempting to change out 60 gallons of glycol (you really can't do it

[ED NOTE: Fred is an long time ATV'er from Indianapolis area, displaced to the Colorado hills. This is from his column in TV Technology

perfectly), buying a really good flow meter (which is expensive and delicate) and cross-calibrating thermometers.

Fixed Water Method

There is a way to increase the delta-T into the range of reasonability and eliminate flow meters and glycol changes. Better, you don't need to spend a lot of time or money doing it.

The fixed water test rig is composed of a water pump, a plastic barrel, an accurate thermometer (preferably digital), distilled water, a timer and the hoses necessary to connect it to the dummy load.

You are probably was ahead of me, but the idea here is to heat a small, fixed quantity of known pure water over a short period of time.

First, secure the normal dummy load water system and disconnect it. Fill the barrel (I use a common 30-gallon plastic barrel) with five gallons of water. Set the pump (self-priming 10 gpm pumps are available at most hardware stores) to move the five gallons from the barrel through the load.

Once the load is clean, place 20 or so gallons of water in the barrel and rig the pump and hoses so that the water cycles from the barrel through the dummy load and back into the barrel: a simple closed-loop system. To make future setups easy, mark the barrel at the 20-gallon mark, including the water in the load, and mark the lines and pump.

The idea is to operate the isolated cooling system by turning the transmitter on for a fixed period of time and measuring the increase in temperature in the barrel.

The math relationships are as follows:

1) Peak visual power (in black) = average power (what you are measuring) x 1.68

2) 1 BTU raises 1 pound of water 1 degree Fahrenheit (at 39.2 degrees F)

3) 1 W = 3.4129 BTU/hour

4) 1 gallon of water weighs 8.333 pounds.

So, for a typical test for a UHF transmitter, let's start with 20 gallons, or 166.66 pounds of water. We know that 1 kW will raise the temperature of one pound of water 3412.9 degrees in one hour. Spreading that heat into 166.66 pounds of water means that 1 kW will raise the temperature 20.48 degrees in an hour. Being practical, a 60 kW peak visual power results in an average power of 35,714 W. (Hams divide by 100 or 1000 unless you have an amp like KB9FO!)

Let's shorten the test to five minutes. In five minutes, each kilowatt will raise the temperature 1.71 degrees. That means 35,714 W will raise the temperature 60.95 degrees. Assuming that we start the test with 80-degree water, we should finish the test with 140-degree water. One could run the test for 10 minutes; however, the effectiveness of the cooling system deteriorates rapidly as the water reaches the boiling point. In 10 minutes, the water would be at 200 degrees, but the load would likely be in steam, which at the risk of an understatement is not good.

Itelco's Howard McClure offers two warnings at this point. First, some loads have published limits for flow, maximum temperature and maximum delta-T, which should be followed. He also points out that all of this assumes the proper sync ratio is being observed, which is not necessarily the case throughout the world. He does have all the compensation information, should you be using something other than 40 units of sync, or a 7.5 setup. He can be reached at 303-736-7656.

Warnings observed, 20 gallons and five minutes work well with our 60 kW visual transmitter. Change time and water volume to accommodate larger or smaller power levels.

For this condition, the above formulas can be reduced to delta-T x 0-.58=kW average, where delta-T is in Fahrenheit and average power is desired. For peak power, delta-T x 0.975-kW peak. (The 0.975 is 1.68 x 0.58, which results if you insert five minutes and 166.66 pounds of water into the relationships printed above.)

Practical Experience

I try to make this entire experience last about 30 minutes. Put the warmed up and stable transmitter in black, and adjust its power to read 100 percent. Place the transmitter in standby. Shut off the valves feeding the dummy load and remove the hoses, making some attempt to avoid a mess.

Attach the fixed water barrel and pump. Add five gallons of distilled water, turn on the pump and circulate it a minute or two. Shut off the pump and then drain the hoses, load the pump, and dispose of the first five gallons of water. Replace this with 20 gallons of water. Prime the pump and continue the operation with the fixed water cooling system in place. Connect the transmitter output you wish to measure to the load.

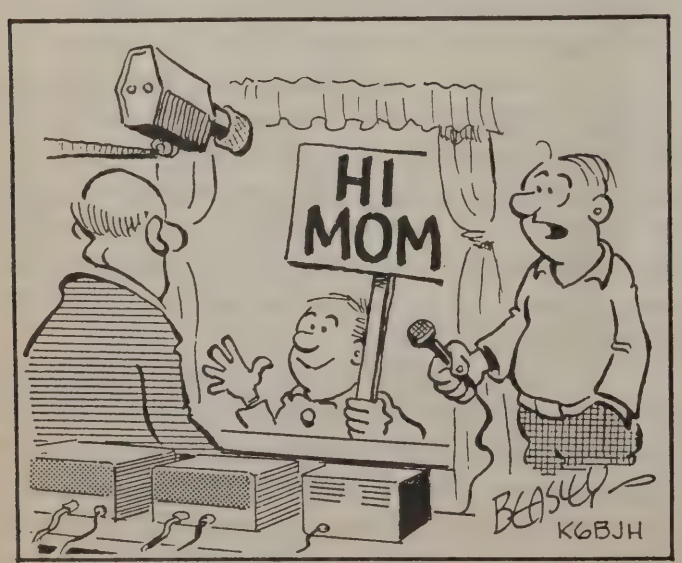
Before you fire up the transmitter, check to see that all the bubbles are out of the lines, flow is good and that the thermometer and the entire setup will survive at least 10 minutes with really hot water. This means you need good, domestic hoses that are fastened securely. Cheap hoses will get soft and collapse, cutting off the flow if they don't melt first. Turn on the transmitter and readjust power for 100 percent.

Take a temperature reading immediately after the rig is stable and start the timer. When I tried this today, I got 79.3 degrees. Five minutes later, I read 144.5 degrees. Put the transmitter back in standby. Do the calculation (144.5 - 79.3 x 0.975 = 63.57 kW. Oops, too much power...I guess the tube isn't going south!) No wonder I'm stretching sync a bit!)

I can still run the transmitter for another minute or so before I melt the hoses and fill the room with steam, so I make another quick calculation and determine the meter should read 105.6 percent. I turn on the transmitter, readjust the power for 100 percent and then adjust the meter calibration pot to read 105.6 percent.

I'll drop the transmitter back to 100 percent later, but now the water temperature is 160 degrees and too hot to handle. This heat sink is full. I reconnect the normal cooling lines and proceed, some 30 minutes later, knowing the meter on the transmitter is pretty close to reality. I'll dump the used water when it's cool the next day, or maybe, using my 20 gallon reference mark, make up the half gallon or so I lost and calibrate the aural or the auxiliary before dumping the water into the main cooling reservoir.

There are still two errors that will make the measurement appear slightly lower than in reality. First, the last hot water in the load takes a few seconds to get to the barrel and the thermometer has a few seconds of lag before it accurately reads the temperature. With 20 gpm of flow and fast thermometers, this is not likely to amount to more than 1 percent error. It can be corrected by letting the thermometer and water temperatures stabilize for approximately 15 seconds at both the start and the end of the process. But this would require a transmitter that will come up to power without variation and stay there through the test period, which is rare.



I KEEP TELLING HIM IT'S ONLY ATV, AND HIS MOTHER PROBABLY ISN'T WATCHING

The second error comes from undesired cooling from the hoses, the barrel and most of the load itself into the adjoining transmission line or waveguide. To get a handle on how much this might be, take another temperature reading 2 1/2 minutes after your final test temperature. In this period of time, the water should have cooled a bit.

Getting Testy

This same cooling was going on while you conducted your test. If the test was fairly quick and the quantity of water significant, this cooling should account for maybe 2 percent error. If the test is long or the water quantity small, the error might be significantly more.

The reason for determining the temperature los over only one-half the test time is that the amount of heat lost to incidental cooling increases as the temperature of the water increases above the ambient room temperature.

This means there is no cooling loss at the beginning of the test - when everything is at room temperature - and there is a larger amount at the end of the test when the system is hot. If the cooling loss seen over 2 1/2 minutes is significant, add this to your delta-T before multiplying to get the power.

Of course, if you are creatively lazy, you'll notice that if you used 1.0 instead of the 0.975 multiplier, it would give you a power that was 2.5 percent higher; which just happens to offset the 2.5 percent typical loss to cooling and thermal hysteresis.

Thus for 20 gallons of water heated for five minutes, each degree of temperature increase represents 1,000 W of peak visual power. Told you it was simple.

Fred Baumgartner is a special projects engineer with TCI's National Digital Television Center in Denver, Colorado. He has served as chief engineer at KDVR/KFCT and WTTV/WTTK.

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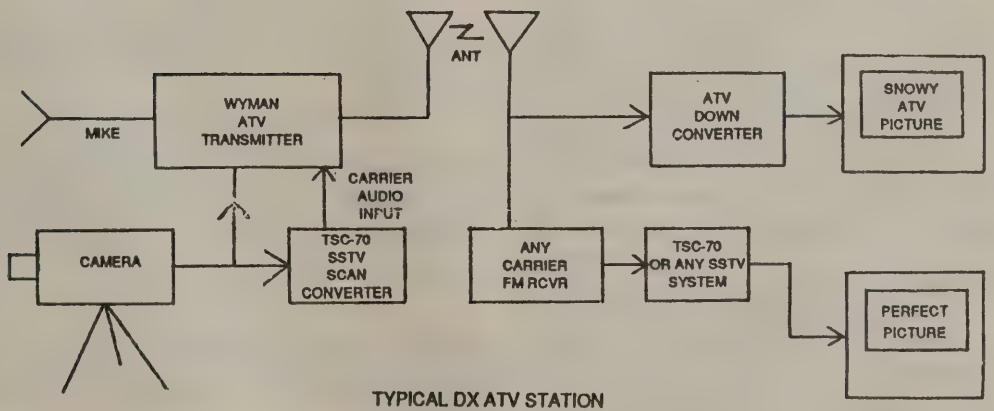

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Baltimore/York ATV Linking Project

By Mike Dees N3EZD

The Baltimore, Maryland, (BRATS) and the York, Pennsylvania, ATV groups decided to attempt to link our ATV repeater systems. Both the York and Baltimore repeaters are configured for 426 in, 439 out, and both have an additional output on 900 MHZ. Unfortunately, the repeater systems are not able to receive each other from their respective location. Therefore, we have been forced to establish an intermediate station for the purpose of linking the repeaters. This station is essentially a cross-band ATV repeater with additional control functions.

Progress toward achieving our goal has not always been forward. For example, BRATS replaced the 900 power amp in our repeater to improve the picture quality, but because of the new power amp's somewhat lower output power the picture received at distant locations was dramatically reduces. We still do not understand why a power reduction of 3 or 4 dB caused the signal at a location to be degraded by two P units. More testing and eventually installing a dedicated link is planned.

Our efforts at establishing a linking station have been centered around using the location of Bob, WB3EAF in New Freedom, PA. Bob has a good path to the York repeater but only a fair path to Baltimore. The linking station receives on the 900 MHZ band and transmits on the 440 MHZ band. There are four antennas installed at Bob's location for linking purposes, a 440 and a 900 MHZ beam antenna pointing toward Baltimore and another pair pointing toward York. Each 900 antenna feeds a downconverter and video receiver. A sync detector samples each receiver's video line, the video then goes to a video relay. The relay selected video is then routed through a video ID generator and then on to the 440 MHZ band transmitter. The transmitter is connected to a coaxial relay that selects the appropriate 440 MHZ antenna for the desired transmission direction.

To control the linking equipment I developed a program for a Basic Stamp microcontroller from Parallax, Inc. Program development using this device is very quick and reprogramming the microcontroller in the field is easy. The link controller provides the following functions:

1. determination of the direction of the received signal,
2. link transmitter identification,
3. transmitter control,
4. control of the retransmission direction,
5. a retransmission timeout timer, and
6. an activity timer to automatically disable the link after a period of nonuse.

A block diagram of the link equipment is shown in figure 1 below. The linking is currently sync operated. This means that the repeaters must drop for the link station to reverse direction. This mode of operation was chosen for the demonstration phase of the linking project because no modifications to either the York or Baltimore repeaters are necessary.

The linking controller has eight I/O ports numbered 0 to 7; they are assigned as follows:

Outputs

0 video relay
1 video ID control
2 transmitter transmit control
3 transmit direction relay
Unassigned 4 5

Inputs

6 York receiver sync detector input
7 Baltimore receiver sync detector input

Once this configuration is fully functional the York and Baltimore repeaters will be modified to transmit a control signal that will initiate linking only when a user is transmitting. Modification to the link station will be easy because of the microcontroller based system.

The current controller sequence of operation is as follows:

(Initial conditions: the controller is in the linking mode and no video signal is received.)

1. The controller scans the York receiver and the Baltimore receiver looking for activation of the sync detectors.

2. When a video signal is detected by one of the sync detectors, the controller causes the video from that direction to be selected by the video relay, the transmit direction relay to select the direction opposite from the receive direction, and turns on the transmitter.

3. The controller then waits for the "link from" repeater signal to disappear. When this occurs the video ID is activated for one second and then the link transmitter is turned off.

4. The controller next checks the receiver for the "link to" direction and waits for the "link to" repeater to drop.

5. The controller returns to the scanning in number 1 above.

BRATS can be reached by email at brats@smart.net and at our Web page http://www.smart.net/~brats.

Baltimore/York ATV Linking Project

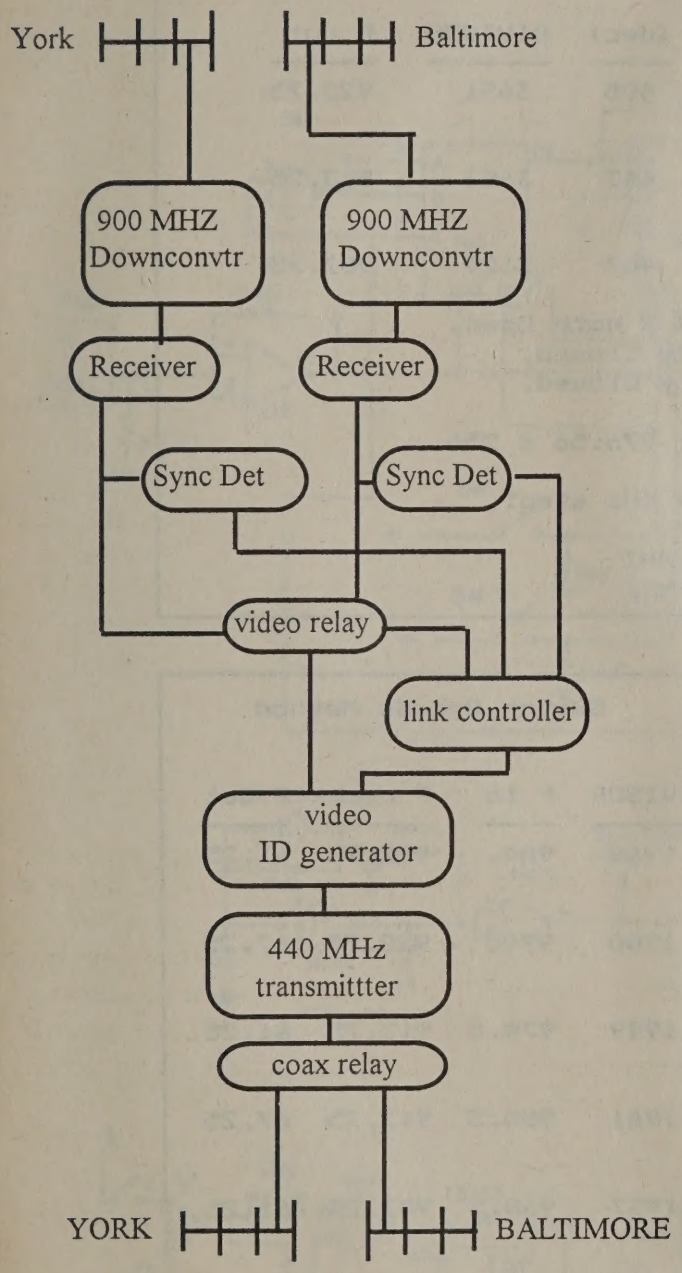


Figure 1

Internet Information

If you have access to the INTERNET, you may be interested to know of some of the HAM related information that is available. We've tried to start a list of interesting places to look in case you get in the "surfing" mood. If any of you find different places to look, I'd appreciate having the information passed on to me so I can include it in the list. The ATCO home page is updated periodically so be sure to check often for late breaking NEWS. The addresses listed below are case sensitive, so type exactly as shown below. (If anyone has comments or would like additional listings, contact me via e-mail at towslee.@mt-two.mhs.compuserve.com.)

http://psycho.psy.ohio-state.edu/w8lt
Ohio State University W8LT radio station

ttp://www.ualr.edu/doc/hamualr/callsign.html
Search by call sign or name

http://asp1.sbs.ohio-state.edu
Local & global weather map info (good detailed info)

http://www.arrl.org
ARRL home page

http://www.acs.ohio-state.edu
Ohio State University home page. Lots of neat stuff.

http://psycho.psy.ohio-state.edu/atco
ATCO home page

http://www.geopages.com/SiliconValley/1242
East Tennessee ATV home page

http://www.portal.com/~jpawluk/KB6MMF.html
California ATV home page

http://www.ladas.com/ATN
Amateur Television Network Central and Southern California

http://mindspring.com/~rwf/aatn1.htm
Atlanta, Georgia ATV home page

http://calvin.ksc.nasa.gov:1080/lisats.html
NASA ATV home page

http://www.stevens.com/HATS/home.html
Houston, Texas ATV home page

http://geopages.com/SiliconValley/1242/wb7fid.html
Salt Lake City, Utah ATV home page

http://www.prostar.com/~Richard.Keller/ham-tv.html
Washington ATV home page

http://www.arrl.org
ARRL home page (not much now-they're new to the net)

http://www.hayden.edu/Guests/AATV
Phoenix Arizona Amateurs

http://citynight.com/atv
San Francisco, California ATV

http://www.njln.net/~magliaco/atv.html
Brookdale ARC in Lincroft, New Jersey

The following address is helpful in searching for many different topics on the Internet. I have found it to be a very powerful search engine especially for ham radio and television topics. At any point when logged onto the Internet, type the following: http://www.yahoo.com/Entertainment/television/Amateur_television for a listing of the available ATV home pages. (The address of http://www.yahoo.com is the table of contents pointer for a vast variety of topics.) [ED NOTE: also see page 21 for R/C ATV home page info]

RABBIT POWER

Jim Korenz N8PXW sent us information on a popular Rabbit unit, model VC5000. Bill Parker W8DMR has taken the time and effort to draw the schematics and tabulate the synthizer data so you know what is in the boxes, and can modify them as desired. Lets get those soldering irons hot!!

RABBIT TRANSMIT (VC 5000) Condition A, B, C

Condition	MSB		LSB	PRESET (dec)	DIVISOR	F out
A	0001	1001	0101	195	405	3691	922.75
B	0001	1011	1011	1BB	443	3653	913.25
C	0001	1101	0011	1D3	467	3629	907.25

Note: Condition, A = Switch 1 and 2 both Open.
B = Switch 1 only Closed.
C = Switch 2 only Closed.

Fout = Divisor x 976.56 x 256

Each count = 250 KHz step.

Input = 910.25 MHZ
Output = 923.25 MHz

RABBIT RECEIVER (VC 5000) Switch Decode Method

Sel	MSB		LSB	HEX	PRESET	DIVISOR	F lo	F rec	F out
A3	1000	0101	0000	850	2128	1968	984.	922.75	61.25
A4	1000	0100	0100	844	2116	1980	990.	922.75	67.25
B3	1000	0110	0011	863	2147	1949	974.5	913.75	61.25
B4	1000	0101	0111	857	2135	1961	980.5	913.25	67.25
C3	1000	0110	1111	86F	2159	1937	968.5	907.25	61.25
C4	1000	0110	0011	863	2147	1949	974.5	907.25	67.25

Note: Channel 3 = 61.25 MHz
Channel 4 = 67.25 MHz

1953.12 x 256 = 0.5 MHz/step

JIM KORENZ,
N8PXW
TABULIZED BY
W8DMR

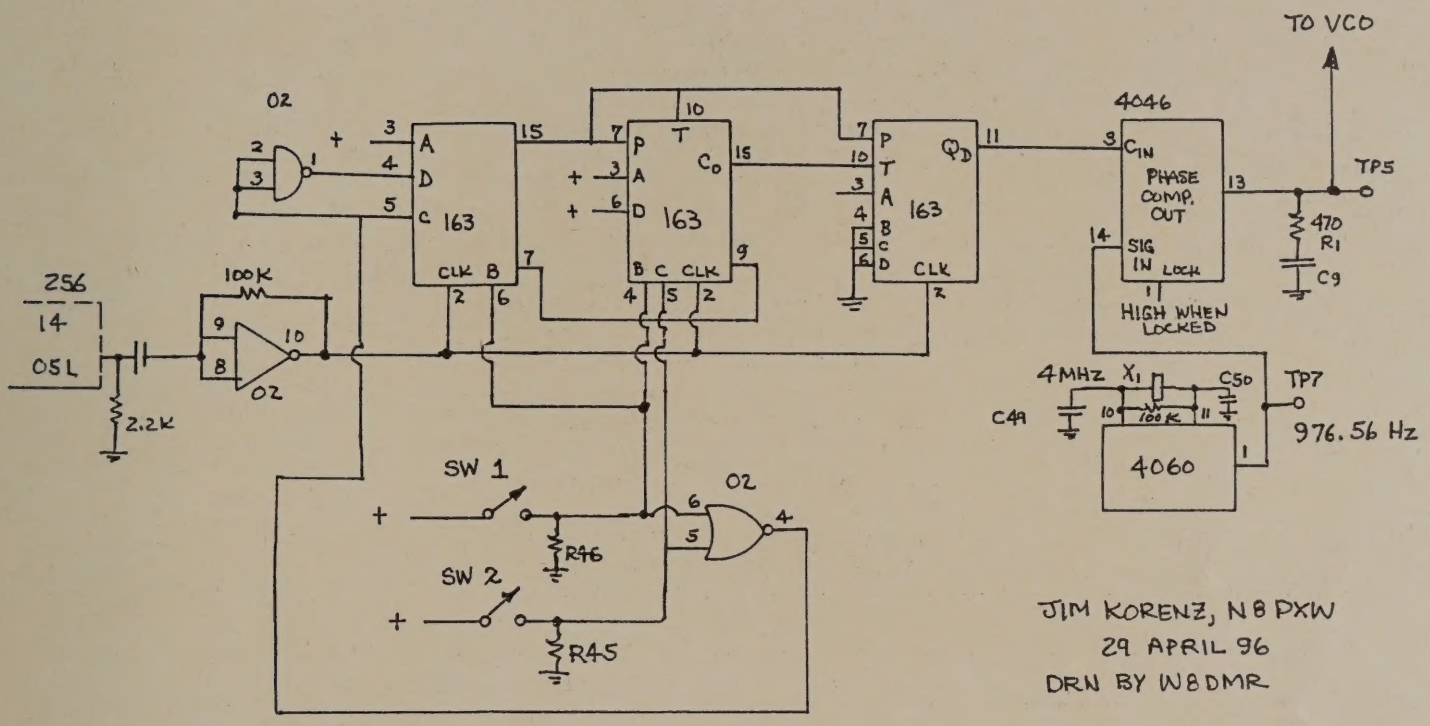
RABBIT POWER

RABBIT TRANSMITTER
SYNTHESIZER
(VC 5000)

BAND 902.0 – 928.0 MHz

A = 922.75 MHz
B = 913.25 MHz
C = 907.25 MHz

976.56 Hz × 256 = 250 KHz/STEP



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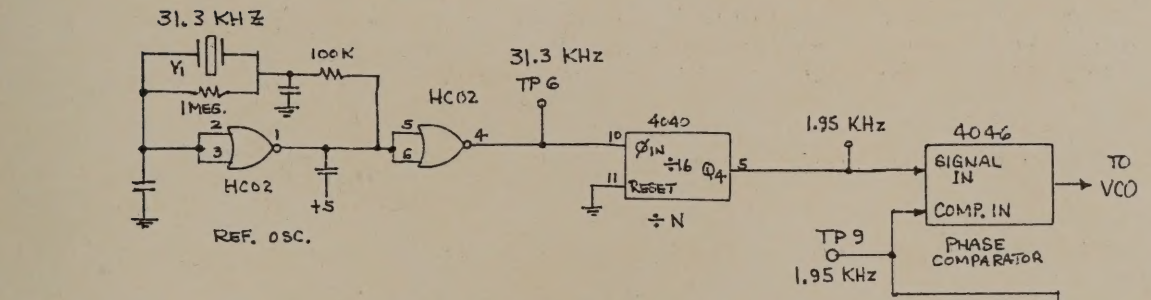

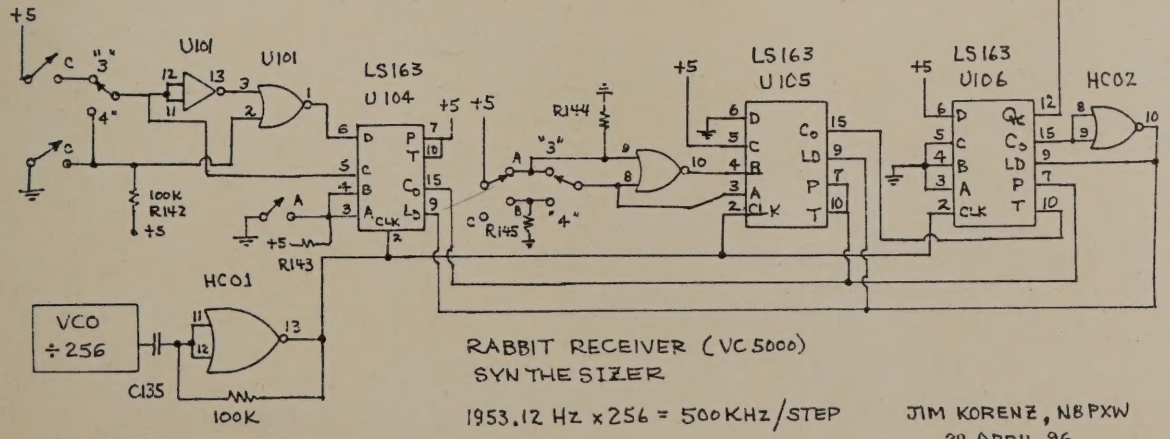

RABBIT RECEIVER (VC 5000)
SYNTHESIZER

1953.12 Hz × 256 = 500 KHz/STEP

JIM KORENZ, N8PXW
29 APRIL 96
DRN BY W8DMR

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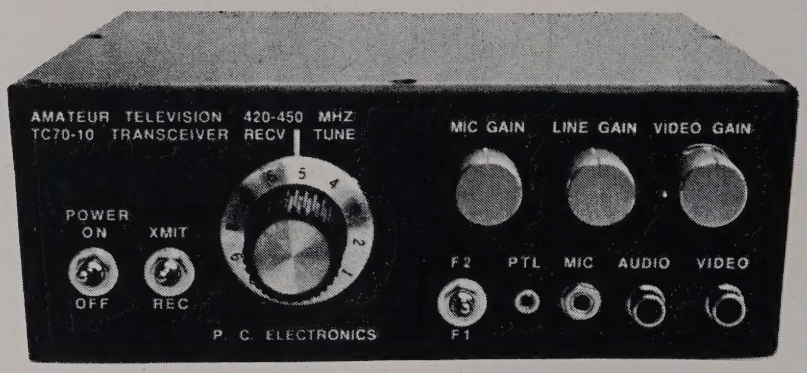

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Specify transmit frequency(s):
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Antennas - see page 5

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KLM	**440-10X**	**11 dBd**	**$82**
KLM	**440-6X**	**8.9 dBd**	**$65**
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